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ABSTRACT

Designed to assist the House Select Committee on Aging in determining how technology can be utilized to improve the quality of life for the older population both now and in the future, this hearing was convened for five specific reasons: (1) to identify applications of technology for the benefit of older persons and mechanisms for their development; (2) to educate Congress and the public about the various technologies that can benefit the elderly; (3) to increase public awareness of the ways technology could facilitate daily living for older persons; (4) to learn about the problems that could inhibit technological developments; and (5) to determine whether market forces can adjust to the economic and ethical consequences of applying such technology. Two panels, consisting of witnesses from the American Association of Retired Persons, Palo Alto Veteran's Administration Medical Center, University of San Francisco, Drexel University, Miami Jewish Home and Hospital for the Aged, and representative senior citizens, presented testimony on the impact of such technologies as robotics and microcomputers on health care delivery and quality of life for senior citizens. Additonal materials received for the hearing record are appended. (JB)

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HIGH TECHNOLOGY AND ITS BENEFITS FOR AN AGING POPULATION

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HEARING

BEFORE THE

SELECT COMMITTEE ON AGING
HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

SECOND SESSION

MAY 22, 1984

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HIGH TECHNOLOGY AND ITS BENEFITS FOR AN AGING POPULATION

TUESDAY, MAY 22, 1984

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON AGING,
Washington, DC.

The committee met, pursuant to notice, at 9 a.m., in room 2359, Rayburn House Office Building, Hon. Edward R. Roybal, (chairman of the committee) presiding.

Members present: Representatives Roybal, California; Daub, Nebraska; and Schneider, Rhode Island.

Staff present: Jorge Lambrinos, staff director; Sheila Duffy, professional staff member; Rich Terlep, press secretary; Paul Schlegel, minority staff director; John Vihstadt, minority counsel; and Donna Fry, research assistant.

OPENING STATEMENT OF CHAIRMAN EDWARD R. ROYBAL

Mr. ROYBAL. Good morning, ladies and gentlemen. The hearing this morning is being convened to assist the House Select Committee on Aging in determining how technology can be utilized to improve the quality of life for the older population now and in the future.

The word "technology" in its earliest usage signified tools and machinery of various kinds. However, we know that it represents more than merely physical entities. Technology can also be defined as the organization of scientific knowledge for practical purposes, and may also encompass applications of sociology and other behavioral sciences.

The impact of technology may not be inherent in the technology itself; rather, it may depend on what people do with it in general.

Today more than 80 percent of the American population will live beyond the age of 70. About 11 percent of our population is currently over age 65. It has been estimated that over the next 50 years the number of persons age 65 and older will increase from its current 11 to 18 percent.

The elderly as a group represents a significant pool of skills, talents, and experience that can benefit society provided that they can maximize their ability to function independently. The current population of older Americans also represents a vast consumer market for products and services which is often overlooked. These products and services could enhance their independence and improve their quality of life.

The ability to do new things or to do old things better is implicit in the meaning of "technology." Technology has the potential to improve all aspects of life for older people. It can enhance their employment, educational, and recreational opportunities, while assisting them to function independently within their homes and community. Technologies that can accomplish these goals need to be available and affordable for the general public.

Today's hearing will provide some excellent examples of the kinds of technologies that are available now and in the future to improve the quality of life for our older population. I welcome our most distinguished witnesses and know that their testimony will help provide Congress and the public with important and much-needed information regarding technology and its benefits for the aging population.

The Chair now recognizes Congressman Daub.

STATEMENT OF REPRESENTATIVE HAL DAUB

Mr. DAUB. Mr. Chairman, thank you very much. I want to commend you for having this hearing today, at which we will have an opportunity to examine recent technological advances and to consider how these developments can be applied to improve the quality of life and increase the independence of our growing elderly population.

It's too easy to assume that older people are not up with the times and are unwilling to adapt to new developments. However, I think we are selling our older population short if we adhere to this misleading assumption. The elderly are just as ready to jump into this technological age as every other age group.

I want to share one example from my own home of Omaha, NE. The Eastern Nebraska Office on Aging, an exemplary area office, which today is celebrating its 10th anniversary of service to seniors, is working with an organization called Computer Classroom, offering computer training to persons over 55 years of age. These older students are exposed to basic computer language and have firsthand experience operating computers. Along with this technical skill that is gained, these persons learn self confidence in handling technological equipment.

The co-owner of Computer Classroom recently commented, and I quote him, "The microcomputer knows no age. Seniors should do very well in the computer age if it gives them the opportunity." End of quote.

Of course, this is a key point. With our leap into this computer age, we have an obligation to develop technologies with the needs of our seniors in mind. New technologies are becoming a common item in every home. While not only for convenience and entertainment, these devices have applications for human services, performing duties we are unable to accomplish for one reason or another. The elderly population, whose abilities often become limited with age, is a prime group to target for these new devices.

I understand that we're going to have an opportunity today to see actual robots that are capable of reaching and grabbing for items, fetching the newspaper, pouring water, fixing dinner, and even sounding an alarm system. I wouldn't mind having one of

those in my own home. It's a fascinating field and, for one, I am sure we have only begun to investigate it.

I will look forward to the contributions that our panel of expert witnesses have to share with us, and do very much appreciate your coming. Thank you, Mr. Chairman.

Mr. ROYBAL. Thank you.

At this point I would like to introduce a briefing paper prepared for the committee.

[The briefing paper for Select Committee on Aging follows:]

BRIEFING PAPER FOR SELECT COMMITTEE ON AGING HEARING—"HIGH TECHNOLOGY AND ITS BENEFITS FOR AN AGING POPULATION"

PURPOSE FOR HEARING

This hearing is being convened to assist the House Select Committee on Aging in determining how technology can be utilized to improve the quality of life for the older population now and in the future. Generally, it is expected that technology will assume greater importance for our older population in the delivery of essential services, the development of products for their use, and making independent living and self-care more feasible.

Specifically, the purpose of this hearing is to: (1) identify applications of technology for the benefit of older persons and mechanisms for their development; (2) educate Congress and the public about the various technologies that can benefit the elderly; (3) increase public awareness of the ways technology could facilitate daily living for older persons; (4) learn about the problems that could inhibit technological developments; and (5) determine whether market forces can adjust to the economic and ethical consequences of applying such technology.

A PROFILE OF THE ELDERLY

Today more than 80 percent of the American population will live beyond the age of 70. About 11 percent of our total population is currently over age 65. It has been estimated that over the next 50 years their numbers will increase to 18 percent. The ramifications of this burgeoning older population are just beginning to be recognized and explored. Concern for the elderly is growing in areas such as health care, housing, financial and transportation services. At the same time, opportunities for education, recreation, and working in the later years are becoming more available.

The elderly as a group represent a significant pool of skills, talents, and experience that can benefit society provided that they can maximize their ability to function independently. The current population of older persons also represents a vast consumer market for products and services which is often overlooked. These products and services could enhance their independence and improve their quality of life.

The elderly population is very diverse in terms of life-styles, health conditions, living arrangements, and economic security. The physical and mental indicators of aging (e.g., arthritis, vision and hearing loss, cardio-vascular disease, and loss of memory) do not necessarily correlate with chronological age.

Just as with other age groups, the elderly face many challenges. Many of these challenges are expressed best in the concept of loss. Although not restricted to old age, losses are more commonly experienced in one's later years. Some of these losses are: loss of work with its concomitant loss of income, status, and participation in society; decline in health, mobility, energy, strength; death of marital partner, older family members, and friends; loss of home and familiar surroundings.

Any of these problems are difficult individually; when they are encountered in multiples, as they frequently are, they put great stress on one's ability to adapt. Certainly, there is a wide variety in people's response to these and other problems. The coping skills that a person has developed over the course of a lifetime will be a vital influence on how she or he handles these new situations.

However, even as these changes occur, older persons still desire intellectual stimulation, self-esteem, sense of achievement, financial security, personal growth opportunities, social acceptance, and, of course, independent living. Wisdom accumulated over a lifetime constitutes a significant national resource that should not be ignored or forgotten.

While research and technologies are available that could result in useful products and services for older persons, they have not yet played major roles in improving

the quality of life for older persons. In many instances, the older population has been overlooked in the formulation of research agendas and in the development and transfer of technology.

WHAT IS TECHNOLOGY

In order to link the current technological explosion more closely to our aging population, and understanding of "technology" is necessary.

The word technology in its earliest usage signified tools and implied machinery of various kinds. However, we know that it represents more than merely physical entities. Technology is also defined as the organization of scientific knowledge for practical applications. This definition may also fall short in some cases as it fails to capture the social ramifications of the word. Technology may also encompass applications of sociology and other behavioral sciences.

A characteristic of technology is that it creates new possibilities for human choice and action. While technology creates opportunities for persons and societies, it also generates problems for them. For example, technology may upset old patterns of relationships and behavior. The impact of technology may not be inherent in the technology itself; rather, it may depend on what people do with it.

One definition summarizes these ideas: A distinction can be drawn between technology as a process and as a product. Technology-as-a-process is those patterns of action by which man transforms knowledge of his environment into an instrument of control over that environment for the purpose of meeting human needs. Technology-as-a product is understood as comprising the range of tools, machines, procedures, etc. produced as a result of technological action.[1]

Technology is commonly recognized as a crucial aspect of the U.S. economy. The profound implications of technological change for economic growth is well documented. What is unique about technology in our nation is its large-scale and its large dollar investment, its impact on our society, and its rapid rate of obsolescence.

Some groups in the United States fear that technology is "getting the best of us." They have denounced many technological advances and have doubted the potential of technology to improve the quality of life. They further state that there is a dangerous unpredictability in the combined effects of multiplying and accelerating technologies. Pro-technology groups contend that advancing technology is necessary for continued productivity gains and is essential to maintain a stable social and economic climate. They say that technological progress has and always will have costs attached to it, but that they are more than offset by the societal benefits it brings.

APPLICATIONS OF TECHNOLOGY TO OLDER PERSONS

As major new technologies generate new capabilities in agriculture, business, transportation, medicine, education, space, environmental control, and in virtually all areas of human endeavor, technology could also have a considerable and favorable impact upon our older population. Technology has the potential to enhance the quality of their lives and reduce years of dependence. Further, technology is now available that could result in extremely useful and relatively inexpensive products and services for the elderly while simultaneously providing profits for industry. Finally, a revised allocation of resources for high technology use by service providers—psychotherapists, physicians, physical therapists, gerontologists, social workers, and others—could reduce the cost of caring for the elderly by society as a whole while increasing the effectiveness of care provided.

The ability to do new things or to do old things better is implicit in the meaning of technology. Technology has the potential to improve all aspects in the lives of older people. It can enhance their employment, educational, and recreational opportunities, while assisting them to function independently within their home and community. The technologies that can accomplish these goals need to be available and affordable for the general public. Today's hearing will provide some excellent examples of the kinds of technologies that are available now and in the future to improve the quality of life for our older population.

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[1] U.S. Library of Congress. Congressional Research Service. Science Policy Research Division. Science Policy: A Working Glossary. (Fourth ed., 1978) Prepared for the Subcommittee on Science, Research and Technology of the Committee on Science and Technology. U.S. House of Representatives. Washington, U.S. Govt. Print. Off., 1978. p. 99.

The first panel will be made up of Mr. Dennis LaBuda, Dr. Mary Furlong, K.G. Engelhardt and Toby Citrin. May I first recognize, then, Mr. Dennis LaBuda?

PANEL ONE, CONSISTING OF DENNIS LaBUDA, AMERICAN ASSOCIATION OF RETIRED PERSONS, INSTITUTE OF LIFETIME LEARNING; DR. MARY S. FURLONG, ASSOCIATE PROFESSOR OF EDUCATION, UNIVERSITY OF SAN FRANCISCO, ACCOMPANIED BY RICHARD DRAPER, SENIOR CITIZEN; K.G. ENGELHARDT, RESEARCH HEALTH SCIENTIST AND EVALUATION SPECIALIST, REHABILITATION RESEARCH AND DEVELOPMENT CENTER, PALO ALTO VETERANS ADMINISTRATION MEDICAL CENTER, PALO ALTO, CA, ACCOMPANIED BY NORTON STONE, SENIOR CITIZEN; TOBY CITRIN, PRESIDENT, WAYS AND MEANS, ROMULUS, MI, ACCOMPANIED BY ROD MacDONALD, DIRECTOR OF CONSUMER AND PROFESSIONAL RELATIONS

STATEMENT OF DENNIS LaBUDA

Mr. LABUDA. Thank you, Mr. Chairman. Members of the committee, I am Dennis LaBuda and I am the senior education specialist at the American Association of Retired Persons Institute of Lifetime Learning. AARP appreciates the opportunity to testify at this hearing on technology and aging.

No one can predict the future and few trends can be identified that are not susceptible to variables which can radically alter the direction of any such trends. There are two trends, however, which barring some unknown catastrophic influence will continue their respective courses and will impact dramatically upon one another.

The first of these two trends is the ever-increasing number of older persons in the United States, projected to grow, as you know, significantly in relation to the population as a whole, through the rest of this century and into the first quarter of the next.

The second trend is the ever-increasing application of technology in our daily lives. The computers, the microchips, satellite systems, and miraculous innovations in areas such as health care, are not going to disappear. We could not, if we desired, reverse the onward rush of technological innovation. Such innovation can be a mixed blessing. New technology can speed the flow and analysis of information, help ensure public health and safety, and make employees more productive. It can also violate privacy, throw people out of work, create social dislocation, isolation, and environmental hazards, and leave those less capable of coping with it vulnerable to its misuse and leave those less capable also vulnerable to victimization at the hands of those who control technology.

The American Association of Retired Persons, a nonprofit, nonpartisan organization, with a current membership of approximately 16 million persons, who are 50 and older, is interested in technology and the impact it will have on older persons. Our primary aim is not to resist technology, but to harness its forces for the benefit of America's older persons. Our interest is twofold. To what extent do older Americans welcome or oppose technological advances, and to what extent can older people help guide technological developments that may impinge on their daily lives?

AARP has been seeking answers to these questions for several years. In June, 1981, we conducted telephone interviews with 608 adults 45 years of age and older, who live in various parts of the Nation. In December, 1983, we replicated the study with a sampling of 700 adults 45 years of age and older. It is the result of these two surveys designed to measure attitudes towards and use of technologies that I wish to share with you.

Today's older Americans have lived through more technological change than any previous generation in history. They are not alien to technological concepts. In fact, they accept much of today's technology as a normal part of their lives. Like younger people, they accept without serious misgivings the changes in lifestyle brought about by automobiles, airplanes, telephones, and television. These technological developments are acceptable because they have become familiar.

Some of the less obtrusive products of technology such as computers and robotic devices still require some getting used to. There have been few studies undertaken to determine the attitudes of older people towards technological developments. Our information, which we consider sketchy evidence, would suggest that older people appear to be more reluctant than younger people in acknowledging the value of newer, less familiar forms of technology. However, from June 1981 to December 1983, there was a 10-percent increase in the use of automated bank teller machines, while the use of computers, which such bank machines are, appeared to drop by 2 percent.

One of the difficulties we have encountered, and one which plagues this whole area of inquiry, is how to phrase our questions in language that is precise and readily understandable. What do we mean when we talk about technology? Generally we do know that older persons are most interested in products that will meet their basic personal needs. They are less likely than younger people to be swayed by fads of the moment. Their acceptance of technological innovation corresponds directly to a perceived immediate relevance to their lives.

A bank teller machine fulfills a specific beneficial function. The applications of a home computer might not be as apparent. Yet, the initial research with which we have been in contact suggests that older persons exposed to home computers are no more or less likely to become involved in home computing and perceiving its applications than their younger counterparts.

For example, in our 1981 and 1983 surveys, 79 percent and 89 percent, respectively, of the respondents indicated that they had never played a computer video game. This would suggest that older people are decidely more ambivalent than younger people in their acceptance of such technologies. Yet, actual experience suggests otherwise. A home for the aged in suburban Washington, DC, won high favor with its residents by introducing computer games. Since most of the residents were over 80 and infirm, the games were adopted for poor vision and reduced manual dexterity. In playing the games, the older people felt they were a part of the "modern age," and, perhaps of greater importance, they had a common interest to share with children and grandchildren.

Both of our studies indicate a strong relationship between technology views and actual use. Older persons who do not have strong positive feelings about technology are likely to never have used it. However, those who do have positive feelings about technology are more likely to have used it.

There are clear and significant signals that older persons' attitudes towards technology correlates directly to income and education. The higher the income and educational levels, the more positive older Americans view technology and the more likely they are to use new products. Men are more likely than women to have positive reactions to technological advances. Yet, women are more likely to use computers and bank teller machines.

We did find that the older the individual the less likely it was that he or she had used items such as computers, cable television, or even an electronic calculator.

Old persons are likely to reject any technological advance that decreases their opportunity to socialize and that tends to isolate them.

When asked to respond to the statement, "Life is going to be better when people are able to do their banking, shopping, and a lot of their other business from home using telephone or cable television," only 34 percent of the respondents in both 1981 and 1983 agreed.

They are, however, attracted to products that enhance their capability for independent living, both in their communities and in their homes. Thus, older people are more likely to accept new technologies which give them a greater sense of physical and emotional well-being.

When asked about an artificial gland, a device that can be planted in the body to automatically control the flow of medicine, 56 percent of our respondents felt that such a device would be useful. Those whom we interviewed also gave high priority to the development of medical and emergency alarm systems.

In both 1981 and 1983, 91 percent of the respondents felt such devices would be useful. In 1983, 93 percent of the respondents felt a similar device for contacting the fire department in case of a fire would be useful.

At this point it appears that Americans over 45 are split in their opinions of technology and technological improvements. When asked to react to both favorable and unfavorable statements about technology, older Americans appear to have no consistent preference.

When asked to react to statements such as, "Machines are doing too much that ought to be left for people to do," in 1981, 50 percent agreed and in 1983, that figure was 52 percent. To the statement, "Improvements in technology really haven't made life easier, just more difficult to deal with," in 1981, 50 percent agreed and in 1983, that figure dropped slightly to 47 percent. However, to the statement that, "Improvements in technology make it possible to get things done faster and more accurately than ever before," in 1981, 83 percent agreed, while in 1983, that figure came down to 74 percent.

I hasten to point out that what we are talking about here is today's generation of older Americans. As future aging cohorts

intersect with evolving technologies, important moral, social, and economic issues will arise.

Future generations will likely have had greater opportunity to familiarize themselves with current newly emerging products and services—and their reactions to technology may well be more positively oriented.

Our preliminary research indicates a variety of attitudes toward technology among older persons, with no strong preferences. It also indicates varying degrees of use of new technologies and variations in perceptions of future need and impact. More research is needed. It needs to consider variations among different subgroups of older people. Information is also needed on where technological applications might be welcomed by various groups of older persons, and where such applications might be resisted. In areas where applications of new technology seem inevitable or are desirable, research which suggest methods of easing the transition and encouraging use are needed.

For these reasons, the American Association of Retired Persons, in addition to its research efforts, is looking for ways to collaborate with American business to involve older persons in the development of technologies.

Designers, engineers, and manufacturers would profit by using older people as consumer advisers, as testers of products before they are marketed, and as instructors of other older people in the use of new products created by today's technology.

The Institute of Lifetime Learning, the education service of AARP, and other AARP departments, are looking at ways to help both our members and business gain the most from technological innovation and development.

Technology can continue to serve the elderly but to do so effectively the scientific, engineering, and industrial communities must work hand in hand with the elderly and with those who are their advocates.

There is an urgent need to identify areas in which technology can assist older people in a cost-effective way—and to develop new products that older people will actually use to their benefit.

Technology is only a means to an end. It is a tool that can be used well or abused.

Older Americans neither view technology as necessarily good or bad. Positive attitudes appear directly related to usability. I believe that older Americans are and will continue to be accepting of technological innovation given that in such innovation we never forget the human element. We should strive for technologies that bring people together in a greater sense of brotherhood, not technologies that tend to isolate people or that intrude in interpersonal relationships.

Again, we appreciate the committee's interest in this important area and I will be happy to answer any questions you may have.

Mr. ROYBAL. Thank you, Mr. LaBuda.

The Chair now recognizes Dr. Mary Furlong.

STATEMENT OF DR. MARY FURLONG

Dr. FURLONG. Good morning, Congressman Roybal and members of the Select Committee on Aging. I am Mary Furlong, an associate professor at the University of San Francisco.

Dr. Greg Kearsley, chief scientist at Courseware, Inc., and I have been conducting research on teaching senior citizens about computers. I am here today with a group of seniors from our classes to discuss our research results.

As you know, a great deal of attention is currently being given in the education and business world to the subject of computer literacy. The advent of inexpensive microcomputers and the general pervasiveness of computers in daily life has made understanding how computers work an important topic. However, few people have been concerned with the interests and needs of senior citizens with respect to computers.

Senior citizens have a variety of personal reasons for wanting to learn about the computers. Through the media, they have heard and seen a lot about them. Many of their children use computers in their jobs or work as program analysts. They see their grandchildren playing computer games in school. They want to know what all the fuss is about, how they work, and how they can use them in their lives.

In the spring and summer of 1983, we conducted a series of computer literacy workshops specifically for senior citizens in the Washington, DC, area. We were interested in discovering what kinds of computer applications seniors were most interested in, and the best way to teach them about computers. We were also interested in finding out what problems they might have in learning, as well as what current hardware and software suited their needs. More broadly, we were interested in finding out if computers could stimulate the intellectual curiosity of older individuals.

We conducted 14 workshops to approximately 300 senior citizens. The workshops were held in a variety of settings, from nursing homes to senior citizen centers. The age range of the participants was 57 to 95, with the median age being 69. We provided the equipment for the workshops. There was no fee.

The content of the workshops focused on three areas: The use of computers for fun, the practical applications, and programming. We began by having all participants play games on their computers, games like cribbage and Pac-Man. By starting with games, any initial anxiety about using the computer was quickly eliminated in an enjoyable way. Now Mr. Richard Draper, one of our students, will tell you about the programming part of the workshop.

Mr. Draper?

Mr. DRAPER. Mr. Chairman and Mr. Daub, we learned six basic, simple programs in basic after mastering the keyboard. We were able to type in these programs. And we did, in fact, do that. I have an example I might give here, if appropriate.

Mr. ROYBAL. Please proceed.

Mr. DRAPER. Thank you.

Mr. ROYBAL. Why don't we come on over there?

Now go ahead.

Mr. DRAPER. OK, this is a basic program. After we learned these initial commands, we were able to modify the program. As a matter of fact, my wife and I were able to set up a little program.

Dr. FURLONG. Needless to say, we stressed programming because that became the seniors' favorite part of the workshop. Participants also learned to do word processing and electronic spread sheets, to balance budgets and so forth. We also demonstrated use of a modem to access remote data bases for electronic mail.

One major strategy that we used in the workshop was emphasis on hands-on experience. We believe that an understanding of computers can only be obtained through actual keyboard experience. The most important result, from the perspective of the participants, is that learning to use the computer is a very engaging activity.

We conducted followup discussions and found that seniors were overwhelmingly positive about their experience learning to use computers. Programming was the part they liked most. They were patient and persistent programmers. They found programming challenging and felt it helped them understand the computer. They also found word processing and electronic spread sheets interesting. They weren't too excited about games.

Although we expected some problems with physical disabilities, we encountered few. In general, the interest and motivation of the participants was so high that any minor problems were overlooked. We didn't observe any real differences between seniors and other age groups that we have taught about computers.

Based on our experiences we have written a book called "Computers For Kids over 60" to be published by Addison-Wesley in the fall. It is an introduction to computers for seniors and it includes sample programs and resources for learning. We would encourage universities, adult education centers, and computer stores, to offer computer courses for seniors. In keeping with this recommendation, the University of San Francisco will offer a class in the fall.

For our next research project we will explore the use of telecommunications with the elderly. Specifically, we are interested in establishing a senior citizens' special interest group on a communications service. With the advent of home banking and electronic shopping, seniors will be able to access information and services from their homes. We hope that computer vendors and software developers will show an interest in the educational needs of senior citizens. Discount and special interest groups would encourage senior citizen centers, nursing homes, and senior citizens to purchase computers.

As legislators begin to plan for the implementation of computer technology in schools, we hope they will consider the needs and interests of older adult learners.

Research could be conducted to determine the kind of software seniors would like to see developed.

I thank you for this opportunity to share our research findings with you today. Senior citizens represent a tremendous, untapped, intellectual resource, as well as a growing segment of the population. Computers are a powerful productivity tool and quickly becoming pervasive.

As you can see from the enthusiasm of the seniors here today, we think that the combination of seniors and computers is an important development which should be nurtured. Thank you.

[The prepared statement of Dr. Furlong follows:]

PREPARED STATEMENT OF DR. MARY S. FURLONG, ASSOCIATE PROFESSOR OF EDUCATION, UNIVERSITY OF SAN FRANCISCO

ABSTRACT

A great deal of attention is currently being given in the education and business world to the subject of computer literacy. The advent of inexpensive microcomputers and the general pervasiveness of computers in daily life has made understanding how computers work an important topic. However, few people have been concerned with the interests and needs of senior citizens with respect to computers.

In the spring and summer of 1983, we conducted a series of computer literacy workshops specifically for senior citizens. We were interested in what seniors wanted to know about computers, what kind of applications they would find of interest, and how best to teach them. The workshops featured a high degree of hands-on activity using home computers (Commodore VIC-20s) and commercial software.

We found that the seniors in our workshops had little difficulty understanding how to use computers. They were most interested in programming, followed by practical applications such as word processing and budgets. They did not find games particularly interesting.

In general, we concluded that teaching seniors to be computer literate was not significantly different than teaching any other age group about computers. Their motivation and patience easily compensated for any age-related learning deficiencies. Thus, we see no reason why senior citizens should be excluded from the "computer revolution." Most seniors are interested in computers and quite capable of understanding them.

Over the next decade, the number of elderly persons in the U.S. will increase significantly. In 1980, individuals over 65 represented approximately 11 percent of the population; by 1990 they will constitute almost 15 percent (35 million people). These figures mean that an increasing number of older citizens will want or need to understand the computer society that has evolved around them. Furthermore, computers offer the potential to enrich the life of senior citizens by providing increased intellectual stimulation and access to information.

Senior citizens have a variety of personal reasons for wanting to learn about computers. Through the media, they have heard and seen a lot of information about them. Many of their children use computers in their jobs or work as programmers/analysts. They see their grandchildren playing compuer games and using computers in school. They want to know what computers are all about, how they work and the possible applications to their lives.

During the spring and summer of 1983, we conducted a series of computer literacy workshops for senior citizens in the Washington, D.C. area. We were interested in discovering what kinds of computer applications seniors were most interested in and the best ways to teach them about computers. We were also interested in finding out what problems they might have in using computers and how well current hardware/software suited their needs. More broadly, we were interested in finding out if computers could stimulate the intellectual curiosity of older individuals. This report describes our findings and conclusions.

RELATED RESEARCH

A considerable amount of research has been conducted on older adult learning. Peterson (1983) provides a recent survey of this literature. The research suggests that learning activities for seniors should be designed to increase in complexity, be undertaken sequentially, and provide ample feedback. To accommodate for differences in perception, fatigue, and health problems with some older learners, the pacing of the instruction should be slow, the sound loud, lighting should be good, and all text should be in large print.

Most research recommends that instruction for seniors be conducted in senior citizens centers and religious facilities near the homes of participants. On the other hand, the very successful Elderhostel program has shown that seniors enjoy taking formal courses in campus settings. In terms of content areas, seniors are most interested in travel, gardening, health, religion, finance, crafts and hobbies, history, music, sports and cooking. Table 1 provides data on the activities that retired indi-

viduals pursue from a 1982 survey conducted by the Teachers Insurance and Annuity Association (2200 participants).

Table 1.—Activities of retired TIAA members

	Percent
Reading	92
Socializing with friends	75
Gardening/home improvement	71
Travel	66
Hobbies/crafts	61
Creative pursuits (for example, writing, art, music)	44
Religious activities	36
Community service	35
Sports/physical fitness	34
Professional organizations	32
Associations (civic, fraternal)	30
Formal education programs	28

Probably the most interesting thing about this data is the fact that formal educational activities are the least most common activity on the list.

Very little research has been conducted on the use of computers by senior citizens. Across the country, a number of microcomputer workshops have been conducted for seniors.

The ComputerTown USA project based in Menlo Park, California, has focused on making computers available in senior citizen centers as part of its overall effort to introduce microcomputers to all members of a community. In the only research we know of pertaining specifically to the software needs of the elderly, Weisman (1983) explored the design and use of computer games by the residents of a nursing home. Weisman reported that the games provided enjoyable learning experiences and increased the self-esteem of the participants. The most successful games were those which allowed players to start at a very easy level and progress in small increments to more advanced skill levels as they improved.

ORGANIZATION OF WORKSHOPS

We conducted two kinds of workshops. The first type were two hour sessions. We gave 6 of these one-time only workshops to approximately 70 senior citizens. The second type of workshop was a series of 2 hour sessions held over 4 days. We conducted 3 of these extended workshops involving 36 participants. Participation at any workshop was always limited to no more than 15 people. This limit was dictated by the number of computers available (5); we wanted no more than 3 people per machine, with 2 being the desirable ratio.

The workshops were held in a variety of settings. These included a residential facility for seniors, a nursing home, an employment center for older adults, and several senior citizen centers and church basements. The age range of the participants was 57–95 years with the median age being 69. Participants came from a wide range of socio-economic backgrounds. About two thirds of the participants were women, reflecting the general composition of the elderly population.

The content of the workshop focused on three areas: the use of computers for fun, their practical applications, and programming. We began by having all participants play games on their computers. This included a video game (Gorf), a music composition program, a painting program, cribbage, and a crossword puzzle. Many of these programs used a joystick which simplified interaction with the computer. By starting with games, any initial anxiety about using the computer was quickly eliminated in an enjoyable way.

To explore the practical application of computers, the participants tried out work processing and an electrical spreadsheet. We also demonstrated the use of a modem to access remote databases and for electronic mail. In the programming session, we taught six simple programs in BASIC. After mastering the keyboard, participants typed in the programs as provided. After they had them working, they modified the programs. We also demonstrated how to store and load programs using a cassette recorder.

In the design and teaching of the workshops, we tried to employ all the guidance provided in Peterson (1983). One major pedagogical strategy that we used in our workshops was the emphasis on hands-on exploration. We believe that an understanding of computers can only be obtained through actual keyboard experience. There are a number of implications of this active learning philosophy. Teaching in-

volves tutoring individuals instead of lecturing. Participants proceed at their own pace rather than that of a group. The most important result from the perspective of the participants is that learning to use the computer is a very engaging activity. Another implication of this approach is that one computer is needed for every 2 or 3 participants.

WORKSHOP OUTCOMES

At the end of the workshops, we conducted a discussion to find out what the seniors liked and disliked. We found that the seniors were overwhelmingly positive about their experience learning to use computers. Programming was the part of the workshop that most seniors liked most. They found it challenging and they felt that this helped them understand the computer more than using existing programs. They also found word processing and spreadsheets interesting. Games were of least interest, although the participants agreed that they were a good way to get introduced to computers.

Although we expected some problems with physical disabilities, we encountered very few. In a residential facility, wheel-chair bound participants had some difficulties positioning themselves at the computers due to the lack of suitable tables. Some of the documentation for the programs we used had small print and was hard to read. In general, the interest and motivation of the participants was so high that any minor problems were overlooked. There were no problems reading screens or typing at the keyboard as we had anticipated.

We did not observe any real differences between seniors and other age groups we have taught about computers. They learned at about the same rate, made similar mistakes, and were equally enthusiastic about what they learned. From this observation, we conclude that the lack of involvement of senior citizens with computers is primarily a matter of attitudes not competence. By this we mean the prevalent belief that older people lack the interest or ability to learn about computers. Our workshops suggest this belief is quite inaccurate.

CONCLUSIONS

Although some limited follow-up was done with a few of the participants, we did not really have the opportunity to assess the long-term impact (if any) of our workshops. We wondered if any participants had been better able to participate in discussions about computers, felt a little more comfortable dealing with computerized systems, or even gone out and bought their own computer (or one for their children/grandchildren). We hope to measure such effects at some later date.

We also did not have an opportunity to determine what kind of software seniors would like to see developed specifically for their interests or needs. They did think of applications for the software they used (e.g., using the music composition program to create hymns, using word processing to write memoirs, using data base program to keep recipes and club address lists, etc.) but the workshops were too brief for new ideas to be explored. Clearly, this is an interesting area for further research.

Computer vendors and software developers have so far shown little interest in the specific interests of senior citizens. This can probably be attributed to the belief that seniors are not interested in computers or they do not represent significant buying power. Our workshops have demonstrated that this first belief is incorrect. It is true that many seniors live on modest fixed incomes; however, studies have shown that their disposible income is high relative to other age groups. Discounts and special group purchase rates would encourage more buying of computers and software by senior citizens.

Senior citizens represent a tremendous untapped intellectual resource as well as a growing segment of the population. Computers are a powerful productivity tool and quickly becoming pervasive. We think that the combination of seniors and computers is an important development which should be nurtured.

Mr. ROYBAL. Thank you, Dr. Furlong.

The Chair now recognizes K.G. Engelhardt.

STATEMENT OF K.G. ENGELHARDT

Ms. ENGELHARDT. Thank you, Mr. Chairman and members of the committee.

I am, indeed, honored and excited to be here today. I am a research health scientist and evaluation specialist with the Rehabili-

tation, Research, and Development Center at the Palo Alto Veterans' Administration Medical Center in Palo Alto, CA.

I have highlighted for you in my written testimony the results of the research that has been conducted under the interactive evaluation methodology. It's our hypothesis that innovative technology requires new approaches to evaluate its utility and its range of applications. These data show that it is feasible to use industrial robots to serve humans and that these innovations hold great potential for impacting positively on the independence and quality of life of persons with disabilities and persons of all ages, including the elderly.

There are two trends occurring in our society today that are unparalleled in human history.

One, the unprecedented increase in the number of older persons will continue to change our Nation's demographics and impact on health and human service delivery.

Two, the rapid advances in microprocessor-based technologies are providing us with many new possibilities. Approximately 20 years ago, the computing capability of today's small, personal computer required an entire room. Just 10 years ago we did not have commercial voice technology. Now there is a whole range of voice devices, everything from talking cars to talking toys. You are reminded to buckle up when you get into your seatbelt by a female voice. You are no longer bugged by untimely buzzers buzzing in your ears.

For the first time in history we have the opportunity to begin innovative research in functional rehabilitation of cognitive capabilities, speech, mobility, and manipulation. Our research investigates ways in which robotic technology can be used to increase the independence of elderly persons and persons with physical disabilities. This research does focus on the end user and makes them the primary mover in our development of the robotic technology that you're going to be seeing today.

I should explain to you a little bit about how the interactive evaluation model works. We worked together with a group of people who have both clinical and technical expertise. We also include users of all ages. We work with volunteers. We have volunteer engineers and we have volunteer medical doctors who work with us on a daily basis to help direct and guide us in choosing technologies and applications that would be most appropriate for them.

Interactive evaluation calls for a very close collaboration between these two groups and it asks that we begin to address the following questions: Can an increased level of user input produce a more acceptable product? Can involvement of users and allied professionals help accelerate the product development and diffusion process? What are the best methodologies to use in training a person to control and manipulate state-of-the-art assistive devices, such as robotic aids?

Our research has demonstrated that it is, indeed, feasible to use industrial technology in helping human services. We have trained over 100 people on this system that I'm going to be demonstrating for you today. This is a system that was developed by Dr. Larry Leifer from Stanford University; he's also director of our research center. It's going to be demonstrated to you on your left over here

by Mr. Roger Awad, who has headed up our training with this particular system.

The gentleman that's going to be demonstrating for you is Mr. Norton Stone. Mr. Stone is 71 years old and had not seen this robot until 7 o'clock last evening. He's worked on it exactly 97 minutes and will be demonstrating a series of tasks for you.

I'm not going to go into great detail about our research. You have the results of it in your proceedings. Let me just say to you that our oldest user that we've trained is age 90 and he could complete our standardized task in 30 seconds less time than the average person could. The youngest person we've trained is age 5. We take a very serious multidisciplinary intergenerational approach to evaluating this kind of technology.

You're also going to see three other systems today. Let me differentiate for you the SUVA [Stanford University/Veterans' Administration] system represents clinical state of the art. It is an interactive robot. Mr. Stone will be talking to it and directing it and commanding it. It will be talking back to him.

The other systems you're going to be seeing today have more specific applications and I'm going to slowly walk over here as Mr. Stone starts demonstrating for you, and I'm going to be talking with you a bit more about some of the applications that we're looking at. You have a list of 54 different subtasks that have been identified for skilled nursing facilities. We haven't even started research in home settings, and how this technology might on the independence of older people in their home.

We have barely begun to look at how we might approach congregate living settings, where we could keep three or four people independent in a small, homelike care setting. So, if you will, Roger, if Mr. Stone will start your demonstration now, this is the Stanford University/Veterans' Administration system that you're going to be seeing demonstrated.

[Pause.]

Mr. STONE. Ready. Attention. [Robot awakens.]

Perform.

[Pause.]

Ms. ENGELHARDT. What Mr. Stone will be demonstrating for you today will include some of the categories that we've identified, which are essentially three areas.

Mr. STONE. Perform.

Ms. ENGELHARDT. They are activities of daily living, in which the user would use the system to perform such tasks as feeding themselves, getting themselves a drink, serving themselves a meal.

We are also working with vocational tasks.

Mr. STONE. Perform. Hotel. Enter. [The robot picks up a salt shaker and shakes it over a plate and sets the shaker back on the table.]

Ms. ENGELHARDT. We're looking at vocational applications for robotic technology.

The other area is recreation with tasks such as painting or board games. The task you're seeing demonstrated today is the simple act of the shaking of a salt shaker. It's one of those things that we often take for granted, that we're able to season our own food as

well as serve ourselves. And it's not always so straightforward for a person who is unable to perform that task for themselves.

We do work with this particular robot in, as I mentioned to you, three different areas of task definition, activities of daily living, vacation, and recreation.

Ms. ENGELHARDT. It also is being used for esthetic studies. We will demonstrate a ballet for you, a robot ballet.

Mr. STONE. Perform. Charlie. Enter. [The robot picks up a cup and brings it to Mr. Stone.]

Ms. ENGELHARDT. This work is being conducted by a student who is getting her Ph.D. from Stanford University in education and dance. We think it's very important to the esthetics of developing a system that you begin to think about how it's going to look esthetically.

These systems have to fit into the lifestyle of the human beings that they're working for. So, it's very important that they not only serve them well, but that they serve them beautifully as well.

Ms. ENGELHARDT. This task of picking up a cup and presenting it, was one of our standardized tasks that you have just seen Mr. Stone perform.

He is giving himself a drink of water.

This is a task that was often requested, particularly by quadriplegics who could not use their hands.

Mr. STONE. Perform. Fox Trot. Enter.

Ms. ENGELHARDT. The other tasks that were identified by our users often was just the simple act of handing someone something. That seemed very simple to us, again, but it's the way we interact with each other. We're able to hand something to someone, take something from someone, and, [robot handed a purple flower to Ms. Engelhardt] interact with them in a way that is very human-like.

Mr. STONE. Relax. [The robot goes to sleep.]

Ms. ENGELHARDT. This is a capability for trying to restore function that we're looking at as we're trying to develop this system.

As I mentioned to you, this is clearly clinical state of the art. There's no other system like it in the world. And it's a general purpose assistive device. In other words, we are trying to make it do a great many things. You saw it demonstrate four different tasks, shaking salt, handing a drink, handing something to someone else, and dancing. So, it's a smart robot and getting smarter. We're working hard at Stanford University on sensory development and we're trying to make sure that those advances that are developed are incorporated into the system for later evaluation by an interdisciplinary team that is very end-user focused.

I'd like to walk over here and show you another application. You're going to be looking at a different kind of robot.

The SUVA system is a prototype. This is called a mockup. This is not a product yet. It is in a mockup stage and it will soon be manufactured by Personal Robotics, Inc., of San Jose, CA.

The president of the company came to me and said, "What do we need this particular equipment to do for you and the people that you serve?" Now, this represents a move in technology that's a very serious issue that I should mention.

Security for our older people is a critical issue. I don't know about your housing in this area, but in California they do not allow

pets in apartments, and many of our older people live in apartment buildings where security is, indeed, an issue, and putting in hard wiring security is not always the answer. So, this might be an answer in the future.

[Robot, known as Ropet (TM), speaks.]

Ms. ENGELHARDT. Now, this robot will orient itself to a door and guard the door. It's programmable to different names and it will sound an alarm if an intruder enters.

[Ropet sounds alarm.]

Ms. ENGELHARDT. Our team will be evaluating this technology. We'll be giving feedback to the developers of this system, in terms of trying to let them know exactly what it is the older people are going to need.

[Ropet speaks continuously.]

Ms. ENGELHARDT. We ask questions such as, can they use it? What design would they like? Are they going to be able to live with a system that talks like this to them? Are they going to be able to live with one that looks a little like E.T.? These are very crucial issues.

Now, this one was designed, as I mentioned, for security purposes, to guard. We have another demonstration. These other robots are not designed for health and human services, specifically. But we're beginning to find that the applications are there. The manufacturers are very willing to accommodate us and help us and to work with us to try to develop something for this market. It's an exciting field.

This is the RB5X (TM) robot. It's being manufactured by RB Robot Corp., Golden, CO, and I'm going to present a small demonstration of a task of just simply serving. I have letters from family members whose mothers or fathers had emphysema and family members must be at home with these people during the day to care for their elderly parent, mainly because they can't do things like give themselves a drink of water or pour themselves a drink of water, or give themselves food. So this technology could impact on the lines of family care givers as well.

So, we're looking at this kind of technology and the capability, the possibilities, of being able to use something like this. Now, this particular system is also being evaluated. I was telling some of our visitors here this morning about this. It's being evaluated by a group of older citizens at Peninsula Volunteers' Little House Senior Center, and they're taking this robot and working with it and beginning questions whether it can be used to serve frail, bedbound elderly. It's a small system. It's not intrusive. It moves around.

And the president of this company, whom I just spoke with yesterday, tells me that they have just taken into their business, a device that will dispense pills. So, you can begin to imagine. Now you have a robot that can serve, that can hand drinks now. If it could dispense pills and bring them to the person too. We're moving along. We're beginning to work at developing technologies that really work and that are applicable.

The other robot over here is the Hero-1—made by Heath Corp., Benton Harbor, MI. Again, I think our time is short and I won't demonstrate. But this has been a quick demo just to give you a feel

for the kind of technology that is on the market and that's certainly in the wings for the future.

Getting back to your seats, we're going to conduct the ballet for you. It's a silent feature that we don't have to speak over.

[Robot performs 2 minute choreographed motion called Stardance.]

Mr. ROYBAL. Does that complete your testimony?

Ms. ENGELHARDT. Yes, thank you, Mr. Chairman. I appreciate you allowing us to be here. I would like to end by saying to you that I do think the challenges to our sociotechnological systems are enormous. Innovative designs should transcend age and ability constraints and we do have the potential to do that. We do have the technology at hand to begin addressing questions that we've never been able to address before. It is an exciting era.

Thank you.

[The prepared statement of Ms. Engelhardt follows:]

PREPARED STATEMENT OF K.G. ENGELHARDT, A.B., B.A., RESEARCH HEALTH SCIENTIST, REHABILITATION RESEARCH AND DEVELOPMENT CENTER, PALO ALTO VETERANS' ADMINISTRATION MEDICAL CENTER

Mr. Chairman and Members of the Committee: I am a lifelong learner who graduated from Stanford University with Distinction and Departmental Honors in 1981 and degrees in Human Biology and Physiological Psychology. My area of concentration was neurosciences. While an undergraduate, I was principal investigator on a National Science Foundation Student-Originated grant that examined hospital based home care for disabled elderly. I assisted Franklin Ebaugh, M.D., and William Lowrance, Ph.D., in teaching classes on the Problems of Aging and Health Care and Public Policy.

I spent three months in post-graduate work in England studing the British National Health Service and its delivery system for older citizens. I was Service Director for Upjohn Healthcare Services before coming to my present position as Research Health Scientist and Evaluation Specialist with the Rehabilitation Research and Development Center at the Palo Alto Veterans Administration Medical Center in Palo Alto, California.

I have been supervising evaluation research for the Robotics Aid Project and have developed a model for Interactive Evaluation. Under my supervision, within the last two and one-half years, Interactive Evaluation work has generated 38 professional presentations and publications on subjects ranging from voice-control of a robotic aid to third party reimbursement barriers for evolving durable medical equipment. I have been an advisor on eight Stanford University masters projects and theses and directed over 100 domestic and international public documentations of robotics applications to human services.

I recently co-chaired the Human Services session for the First International Personal Robot Congress and will chair two sessions on Robots in Health Human Services at the INTERROBOT Conference in October, 1984 in Long Beach, CA. I am co-chair of the Health Committee for the Senior Coordinating Council of the greater Palo Alto area and I am on the Advisory Board for Upjohn Home Health Services.

Technology can be used to serve the needs of persons of all ages. The 1980s have ushered in a unique era in human history. We are simultaneously experiencing an explosive growth in microelectronics technology and a burgeoning population of older persons. Technology, including computers and robots, can play an important and positive role in the lives of the elderly. But, we are facing challenges in research, development, design, and evaluation that will impact the way we think about, care for, and rehabilitate our older citizens. The potential for state-of-the-art technology to dramatically affect the lives of older people has hardly begun to be explored.

Paul Haber, M.D., Veterans Administration Regional Coordinator on Aging and member of our group, suggests that: High technology may be divided into several areas. One area would include diagnostic devices, such as the CT scanner or nuclear imaging procedures. A second area would include therapeutic medical and surgical procedures, such as coronary artery bypass. A third area would include health services delivery technology, such as the development of an alternative method of treat-

ment for long-term institutionalization. The fourth area would include drugs, and the fifth would be the area of prosthetics, in which the objective is to help individuals compensate for lost function or reduce the environment hazard to a minimum. Finally, there is a whole area of rehabilitation technology, as differentiated from health care technology, that should be briefly noted.

Rehabilitation technology would include all manner of environmental manipulation to compensate for the gradual loss of vigor, perception, and function by the elderly—i.e., decreased mobility and decreased sensory acuity. (Haber, 1982)

Health service delivery and rehabilitation applications of technology, specifically robotic technology, will be my focus today.

Innovative technology requires new approaches to evaluate its utility and range of applications. The work I will be discussing with you today will demonstrate a new approach to research the (a) feasibility, (b) utility and (c) potential marketability of evolving technologies which can profoundly affect our social structure. The systems you will see today reflect a spectrum of design and development stages and are a representative sample of the state-of-the-art in robotic technology that might be employed in the service of humans.

1. The unprecedented increase in numbers of older persons will continue to change our nation's demographics and impact on health service delivery. Independence, health maintenance, and vitality are required if older citizens are to remain productive and an integral part of our society.

2. Our health care delivery system is seeking alternative and updated methods for providing services to older persons. There is little use of "hi-tech" solutions in long-term care settings. Even in the most progressive skilled nursing facility, there are demonstrable needs for assistive devices that will augment staff capabilities and offer the patient increased independence. There are 4.7 million noninstitutionalized citizens who require assistance with personal care and/or home management. Approximately 5% of the over 65 population is institutionalized. These numbers will rise dramatically in the next fifty years as our society ages. As the number of people requiring care for chronic disabilities increases in the context of limited financial and human resources, the mandate for innovative solutions intensifies.

3. Rapid advances in microprocessor based technologies are providing us with many new possibilities. Approximately twenty years ago, the computing capability of today's personal computer required an entire room. Ten years ago, we did not have commercial voice technology. Now, we have a whole range of voice devices from talking toys to cars that remind you to buckle up. For the first time in history, we can begin innovative research in functional rehabilitation of cognitive capabilities, speech, mobility, and manipulation.

We must start, now, to ask questions about how this technology might be used effectively and efficiently and equitably.

Our research investigates ways in which robotic technology can be used to help increase the independence of elderly persons and persons with physical disabilities. The Veterans Administration/Stanford University Robotic Aid Project created in 1979 by Dr. Larry Leifer, consists of a commercially available, human scale, 6-axis, industrial manipulator (Unimation PUMA-250), driven by high-level software, using totally digital, multiprocessor-based algorithms, voice command unit, and synthesized voice response (Appendix 1). Its initial purpose was to demonstrate that robotic technology can be used by severely disabled individuals to regain functional control of their personal space. This robotic aid is intended to replace lost function, not lost anatomy. I initiated Interactive Evaluation of the system in September, 1981. My work is considered clinical state-of-the-art in human service applications of robotics. This robotic system, presently located at the Rehabilitation Research & Development Center at the Veterans Administration Medical Center in Palo Alto, CA., an extremely valuable research tool and will not become commercially available in its present configuration. The head engineer on this project, Mr. Michael Van der Loos, will be participating in the demonstration today.

None of the other robot systems you will be reviewing today have been designed specifically for health and human service uses. Yet, each of them has potential to address some of the needs of an underserved segment of our population. They represent the product state-of-the-art. I am evaluating them using Interactive Evaluation methodology in order to assist manufacturers in identifying new applications, and design modifications that might be required to meet the yet unaddressed needs of individuals within a wide age and ability spectrum. Robotics and its spinoff technologies offer some of the most exciting possibilities in health and human service delivery today.

INTERACTIVE EVALUATION: AN INNOVATIVE APPROACH

Evaluation is—or should be—an ongoing and integral part of the entire [product] lifecycle . . . A coherent, and well-focused program of evaluation is necessary at all levels of technology [design, development,] diffusion and adoption." (Office of Technology Assessment, 1982)

Interactive Evaluation calls for close collaboration between the clinical and technical arms of the project. It requires an integenerational, multidisciplinary approach to problem solving. The interactive evaluation methodology is a tool to facilitate a flexible, ongoing evaluation process conducted by a team composed of individuals with both technical and clinical expertise. The Model calls for simultaneous investigation of both the machine's and the human's performance. It is hypothesized that this interactive focus will help determine desirable characteristics for both the user and the system and will aid the process of diffusing a more appropriate technology to end-users. The tasks are defined by the user to suit his/her own needs. The evaluation team works with the system and the user to see if the tasks can be accomplished, and if not, why. The model is shown in figure 1.

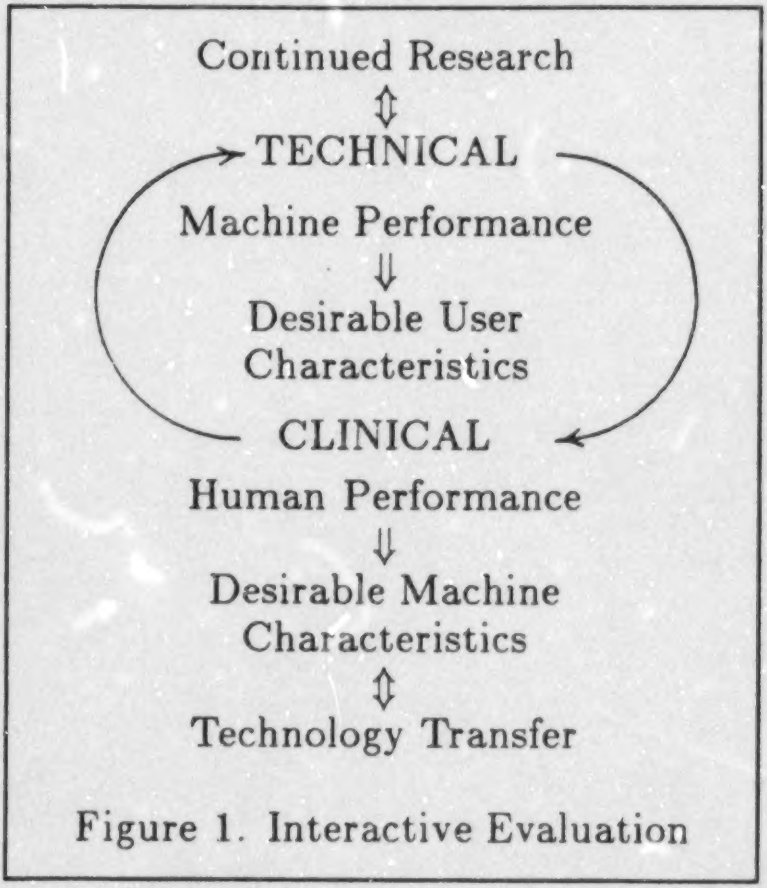

Figure 1. Interactive Evaluation

It seeks to address the following key questions:

1. Can an increased level of user input produce a more acceptable product?
2. Can involvement of users and allied professionals help accelerate the development and diffusion process?
3. What is the best methodology to use in training a person to control and manipulate state-of-the-art assistive devices, such as a robotic aid?

During this evaluation process we have several objectives: (a) develop baseline information on performance characteristics of the human/machine interface, (b) provide current feedback to designers and developers, (c) assess the applicability and acceptability of advanced assistive devices across all age groups, (d) study pertinent psychosocial parameters, (e) generate data on a successful user and successful system profile, (f) determine and evaluate the most effective training procedures for each class of assistive devices, (g) examine technology transfer and diffusion factors in user acquisition of innovative technology, (h) examine the system's integration into the environment. Please see Appendices 2 & 3 for an indepth discussion of the Interactive Evaluation Model.

RESULTS

Over 100 users have been trained to use the Veterans Administration clinical system. They range in age from 5 to 90 years. A 200-page manual has been developed and utilized by people with widely varied educational backgrounds. These levels range from less than a high school degree to possessing the Ph.D. and M.D. Training within the Interactive Evaluation framework is discussed in depth in Appendices 3 & 4.

Training procedures have been standardized and proficiency levels established. Training is accomplished in five sessions which are one to two hours in length. During each session, the user reviews existing expertise, acquires new information, practices the lessons in both structured and unstructured manners, and finishes the session with a task that helps the user assimilate the entire lesson. Our approach employs an adult-learning theoretical framework, known as andragogy. This methodology includes concepts such as: self-directedness, learning readiness, immediate applicability, and problem-centered learning tasks. Results are in Appendix 5. It is important to note that older users were able to complete the tasks as well as younger users with little difference in the time required for completion. Mr. Roger Awad, M.S., has trained a naive user who will demonstrate several tasks for you today.

Appendix 6 contains the most often requested tasks the users would like the robot to perform. All users, particularly quadriplegic users, expressed enthusiasm upon learning to use the robotic aid. The advantages of a general purpose device were corroborated by the range of applications that users of all ages have identified.

The second stage of our research examined attitudes and applications in a long term care setting. The study was conducted in March of this year in the Veterans Administration Nursing Home Care Unit in Menlo Park, California. The listing of research participants is in Appendix 7. Both the Veterans Administration/Stanford University system and the RB5X were taken into the nursing care unit. In the applications area, our team was able to identify twelve major categories of applications for robotic technology with fifty-four sub-groups. The complete list is in Appendix 8; these tasks included lifting, transporting, transferring, ambulating, surveillance, security, housekeeping chores, and physical therapy.

The questionnaire for the attitudinal assessment is in Appendix 9 and includes some questions from studies conducted by Sanford Dornbusch, Ph.D., Stanford University and Iseli Krause, Ph.D., Syracuse University. It was administered to two groups: a "Clinical" group and a "Technical" group.

The data from the "Clinical" group were from two different pools: (1) VA Nursing Home Care Unit, Menlo Park, CA which included nursing staff, administrative staff, and one physician, (2) American Association of Homes for the Aged Conference in Washington, DC (March, 1984) and included administrators of non-profit longterm care facilities.

The data from the "Technical" group were responses from attendees of the West Coast Computer Faire (March, 1984) in San Francisco, CA. These people had technical and computer backgrounds, attended a session entitled "Robotics", and might be thought of as "robot enthusiasts".

Our experimental group consisted of the clinical respondents, while the control group consisted of the Technical respondents—the robot enthusiasts. I will highlight some of the more interesting results.

100 percent of the Clinical group agreed with the statement, Robots can be used to serve people, while 92 percent of the Technical agreed with that statement.

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97 percent of the Clinical group and 87 percent of the Technical group agreed with Robots have many beneficial applications.

94 percent of Clincial group and 87 percent of the Technical group agreed with the statement, Computers have made living easier.

The results of our research would indicate a very positive response to computer/robot technology. In general, all respondents described robots as positive, valuable, and useful. The Clinical group were very enthusiastic toward human service applications of robotic technology. They resembled the Technical group (robot enthusiasts) in many of their reponses.

Informal surveying and interviews with the patients who participated indicated overwhelmingly positive responses. Statements such as, just think what I could do with three of them or the robot is my brother have been made repeatedly.

INTERACTIVE EVALUATION AND INDUSTRY

Commercial products, prototypes, and mock-ups transferred into the Interactive Evaluation process are put through much the same evaluation cycle in order to give constructive feedback to the manufacturers about their products. I have three demonstrations for you today of robots in two different stages of commercial development.

The first RB5X, manufactured by RB Robot Corporation of Golden, Colorado. RB Robot corporation brought the RB5X into our laboratory last November to be evaluated. RB5X was placed in the home of one of our team members who is a recent masters graduate of Stanford University in Interactive Educational Technology and who has a high level spinal cord injury. He, Brodie Lockard, along with two volunteer students from Cogswell College (Bill Heinemann and Barbara Kelly) in San Francisco, CA, programmed this activity of daily living task demonstration (retrieving a glass of water).

RB5X is also being evaluated by a computer club at a multipurpose senior center (Peninsula Volunteers' Little House) in Menlo Park, CA. Matt Lehmann, a retired colonel and Stanford Physics lecturer, teaches several computer programming classes to senior citizens who attend Little House. In addition to learning to program the RB5X robot, the class will assess its potential for assisting homebound, frail elderly. Their recommendations will add much evaluation and market information about the features required of personal robots, if they are, indeed, to serve older humans in the future.

A Stanford University medical anthropology graduate study (Merry Lee Eilers) under my supervision is studying these seniors' attitudes and motivations for learning computer programming.

RB5X and HERO ONE, manufactured by Health/Zenith Corporation of Benton Harbor, Michigan, were very well received in a joint demonstration at an adult day care center in Los Gatos, CA earlier this month. I will demonstrate HERO ONE for you now.

Ropet is in the "mock-up" stage of development; it is to be manufactured by Personal Robotics, Inc., San Jose, CA. This system won first place in the first International Tournament of Robots last month. It is undergoing active evaluation at our laboratory. It will demonstrate a personal security task. In an era when many older persons live alone and in apartments that will not allow pets, personal safety and security are critical issues.

FUTURE

Our work will continue to examine evolving robotic technology and the role it can play in human independence. We anticipate a continuing move toward the merging of industrial and personal robots. We expect voice control and sensor technology to play pivotal roles in future widespread applications of robotic technology.

We will begin to look at the use of these robots and their impact on costs in health care. A recent business journal article stated, For a health care industry looking to cut costs while retaining high margins, robots represent a new and practical technology that allows the automation of processes that simply could not be automated previously and that could provide a competitive edge for forward-looking companies. (In Vivo, 1984, see Appendix 10)

We have demonstrated the feasibility of using robotic technology to serve severely disabled and older people. The Veterans Administration is continuing its vanguard role in researching the utility and potential marketability of robotic assistants as the technology's capabilities expand.

CONCLUSION

The blending of medical expertise and engineering know-how, combined with interactive evaluation throughout the product's life-cycle and industrial interests, could result in assistive robots that have the potential for improving the quality of life and increasing the independence of the elderly. The time has come to bring out older citizens into our technological society of the 1980's. The challenges to the sociotechnological system are enormous. Innovative designs which transcend age and ability constraints, and applications of state-of-the-art technology to humans of widely diverse ages holds the promise of helping us create a forgiving environment in which all humans can thrive.

[EDITORS NOTE.—The attachments to Ms. Engelhardt's prepared statement have been retained in committee files, and may be reviewed upon request.]

Mr. ROYBAL. The Chair now recognizes Mr. Toby Citrin.

STATEMENT OF TOBY CITRIN

Mr. CITRIN. Thank you, Mr. Chairman, and members of the committee. That's a tough act to follow, Mr. Chairman.

My name is Toby Citrin and I am president of Ways and Means, a new business owned by my brother Martin and myself, located in Romulus, MI. I am accompanied today by Rod MacDonald, our director of consumer and professional relations. We appreciate your invitation to testify today. We hope that some of the insight which we gained over our 3½ years of planning this business might prove useful to the committee in its consideration of this critically important and timely set of issues.

I'm going to focus on the need to reorient existing technology and, even more importantly, the need to reorient the marketing of existing products in a manner best suited to meeting the needs of older people. There now exists, Mr. Chairman, a multitude of products which would provide valuable assistance to older people desiring to live vital, active, and independent lives. But American business has yet to market these products to the people in need of them.

Perhaps the quickest way that I can state the problem we're attempting to solve is by showing you products representing two divergent approaches to extending the capability of their users. We have brought with us, courtesy of the Arthritis Foundation, a kit for people with arthritis, representing traditional aids addressing the needs of the elderly, products which have been in general use as recently as 5 years ago.

[Pause.]

Mr. CITRIN. Now, I can assure you that each one of these products, each one of these aids, adequately performs the function for which it was designed. But I ask the committee members, who of you would feel good about using these aids in public? Without exception they've been designed with almost no concern for esthetics and, without exception their use would be perceived by both the user and an observer as a sign of illness and dependency.

Moreover, aids of this type have been traditionally sold in an atmosphere laden with wheelchairs, crutches, bedpans, and other symbols of sickness and disability. And surely this stereotyped approach needs to give way to a more enlightened image of our increasingly active aging population.

At the other end of the product spectrum is this Casio solar cell calculator. Its large pushbuttons, its large digital readout, the absence of any tiny on-off or function control switches, make it an easy calculator for use by persons with arthritic conditions or with low vision. Yet, in spite of the ideal nature of this product for an aging population, its marketing has not been targeted at the elderly or at other people with physical limitations.

Ways & Means, our new business, has been planned to address the problems represented by these two examples. Through a continuing process of selection and evaluation, cooperation with appropriate professionals, and combined with mainstream marketing methods, it's our objective to erase the distinction which has heretofore separated traditional aids made for the disabled from mainstream products sold to the general public.

Indeed, our business is based on the premise that there is no inherent difference between a walker, a pair of glasses, or a hammer, that each of these products is a tool for living, extending the capability of its user, to perform a function otherwise restricted by the natural limitations of the human body.

Society has drawn an arbitrary line between these products, viewing the pair of glasses as a natural and even high fashion accessory, the hammer as having no relationship at all to limitations, and the walker as a badge of infirmity.

Let me briefly describe how we plan to erase these arbitrary distinctions in our own product and marketing strategy, replacing an emphasis on disability with an emphasis on capability.

With respect to product selection, we have brought together under one roof approximately 750 products from around the world, all of which share one common characteristic, their ability to extend the capability of the user to perform some function of daily living better, easier, with less pain, or with less discomfort than would be experienced without the product's use. Indeed, they all do what the chairman, in his introductory remarks, introduced as what technology is all about, and I quote, "the ability to do new things or to do old things better."

In each case we've searched for that product which serves best. Let me show you a few examples. We're talking about functional performance, pleasing appearance, low cost, and good value.

These Bennett curved knives are examples of a number of our products from pots and pans to tennis rackets which have been designed along ergonomic principles. The so-called Bennett bend represented in the 19-degree angle of the handle, has been scientifically designed to enable the user to maximize his or her strength, increasing it by as much as 50 percent, and to minimize strain, injury, or pain.

The Bennett bend knife is, thus, an example of a product which is presently available, has significant potential for the elderly, but which has not yet been targeted at them. It's also an excellent example of a product which links older people, people with limitations, and the public at large, since its benefits have relevance to all persons using knives in the kitchen. It thus bears no stigma of dependency or inferiority and need not be sold as an aid restricted to a disabled minority.

This Gustafsburg reacher is an example of making significant improvements to a traditional aid, both in function and appearance. In its earlier versions, the reacher's institutional appearance and its marketing through sickness-oriented stores, has been a barrier to its use for a majority of people to whom it might be beneficial.

Now, while this new version of the reacher has its limitations, its improvements include a more pleasing color and surface, making it fit in with the environment of a good-looking kitchen, a cuff to provide leverage in lifting, rubberized claws to give a better grip, a magnetized head to pick up metal objects, and a hook to assist in lifting.

The angle adjusts and it folds to allow for easy storage in a shelf or in a drawer.

This reacher also exemplifies a product which links the population with limitations to the population at large, since its benefits extend to anyone desiring to save climbing or bending or stooping, regardless of physical capacity.

Finally, this Royal Doulton plate and this Swedish goblet are examples of the application of the aesthetic dimension to the design of an aid. Plates with rims to prevent food from escaping have been sold for decades by traditional suppliers of aids. But their use on a table was an immediate badge of disability. Royal Doulton's line of these products can be used by anyone sitting around the dinner table, without any negative stigma whatsoever.

The Swedish goblet combines lightness, nonbreakable plastic, and a thick stem to assist grip for people with arthritis. Yet, contrary to the earlier versions of the thick-handled glass, this product is now featured in the Museum of Modern Art's design collection.

The Gustafsburg reacher, the Royal Doulton dinnerware, and the Swedish goblet all share two characteristics which suggest that American product manufacturers have a lot of catching up to do in this area.

Each of these items represents a modern improvement, both functionally and aesthetically, to tradiational aid. Each of them is manufactured by a non-U.S. company and each of them is relatively expensive. They're all victims of a catch-22 phenomenon. American manufacturers are not yet orienting their products to the growing markets of older persons and persons with limitations, evidently because they perceive the market as too small or with little disposable income.

Yet, to a large extent the market is presently too small because of the absence of products combining pleasing appearance with functional effectiveness, sold through modern, well-targeted, marketing methods. Ways & Means plans to market our capability collection of products through retail stores and catalogs, avoiding the images of sickness and dependency. We simply intend to bring together the products and the people who can benefit by using them, through several types of effective, nonthreatening, marketing methods. By doing so we hope to accomplish three goals.

First, to inform the general public and those with special needs that products such as these exist and are available. Second, to make them readily accessible in the mainstream marketplace. And

third, to encourage existing products manufacturers to refocus their design efforts toward this large and growing market.

The key element of our business philosophy is that many, if not all, of the major business opportunities in the United States today are linked with the satisfaction of major human needs. As suggested by Harvard's director of marketing, we hope to become an example of a company which should do well by doing good.

Let me close by suggesting several areas where Government could provide significant help in redirecting American business toward the needs of an aging population. First, in the financial planning for our new venture, we found it necessary to apply for Government assistance by way of a guaranteed EDA loan. We find that nowhere in the criteria used by the various Federal, State, and local agencies involved in the decisionmaking can one find reference to the satisfaction of the needs of an aging population. It would seem reasonable to suggest that meeting the needs of groups which Congress has decided warrant special attention such as older Americans, should be a significant criterion in the prioritization of projects seeking Federal assistance.

Second, in programs providing aid in the development of new products, we find an apparent bias in favor of highly technological research and development. Now, we would be the first to acknowledge the tremendous potential which high technology offers to meeting the needs of older persons. I think that point has been made very dramatically this morning.

However, we would also stress the need to place at least equal emphasis on development of simpler, lower cost products, which can also provide significant satisfaction of the needs of the elderly. We would suggest that a review of programs assisting product research, evaluation, and design be made with this objective in mind.

And finally, as to Government's role in dissemination of information to American business, the American Association of Retired Persons, the Gerontological Society of America, and the Western Gerontological Society, with Health and Human Services support, have produced some excellent information in their continued efforts to reorient American business toward the needs of older persons. The Federal Government should continue and augment these activities by gathering relevant data on needs and marketing opportunities, promoting its broad dissemination to the American business community,and encouraging greater cooperation between the public and private sectors.

Mr. Chairman, I appreciate your invitation, your consideration of my testimony. I'd simply like to conclude by expressing the wish that the future course of our new venture might prove a valuable model for other American businesses desiring to realize the opportunity presented by satisfying the needs of our aging population. I thank you.

Mr. ROYBAL. Thank you, Mr. Citrin. Mr. Citrin, I'd like to start off the questioning with you.

Mr. CITRIN. Yes, Mr. Chairman.

Mr. ROYBAL. You stated, on page 6 of your testimony, that the reacher, the Royal Doulton dinnerware, and the Swedish goblet all have something in common. And you went on to say that each one of them is manufactured outside of the United States and each of

them is relatively expensive. Now, what are some of the major barriers for American industry in meeting the product needs of older Americans, particularly in the manufacturing of those things which you have demonstrated?

Mr. CITRIN. There's no magic to what some of the European countries have done in developing products. It has been a combination of foundation and government support, in some foreign countries, Sweden, Denmark, England, and Norway as examples, which have gone into the combining of aesthetics and functional effectiveness of products to an extent that we have not seen funding go in this country. And this is part and parcel of what I was mentioning in terms of a balance between high technology and simpler product development.

But more importantly, I think we have had too much of a traditional bias by American business and industry on products which they have traditionally perceived as having large markets, and that American business and industry have not yet perceived sufficiently the needs of older populations as being a large and growing market. It's been talked about but we have yet to see it in the development of products.

There's no reason why American manufacturers of dinnerware, tableware, forks and knives, of lamps with tight little knobs to turn them on and off, can't tomorrow start redesigning products with older people in mind. They can do so if they recognize the importance of the growing market, and if people who distribute those products and retail those products will find ways to call attention to the features of the products that have special relevance to the aging.

So, I think it's a combination of some dissemination of information as to what this growing market is all about, what its needs are all about, some incentives, putting together designers with people who know the needs of the elderly, the kinds of people that we have in organizations represented right here in the room today, put together with American business, industry, and ingenuity, and retailers and wholesalers who will start reorienting their marketing to an aging population. I think we need components of all of those in order to achieve the result which we would love to see.

Mr. ROYBAL. In spite of the fact that these items were manufactured elsewhere and not in the United States, and in spite of the fact that there are many problems associated with the distribution of these products that you have demonstrated to us, you still went into the business.

Mr. CITRIN. Yes.

Mr. ROYBAL. What prompted you to do this, you and your brother, to begin such a business?

I'm interested from the business standpoint. I know that there is a service end to this thing.

Mr. CITRIN. I'd be glad to answer, and it evolved over the years. We had been in an earlier business. We had been searching for a new business, several years ago, which would satisfy our desires to do something productive and to earn some money. As a process of research in the general area of health care and related marketing, came to the conclusion by more and more of what we were reading that there was a tremendous need which was not being filled by

existing marketing patterns. We came into this by analyzing a small firm which was manufacturing aids for the disabled, and asking ourselves, "Well, if we were to purchase that firm and make a business out of it, or expanding a business out of it, what would we do with it?"

The research into the whole area of aids for the disabled, and some of the individual one-on-one discussions we had with people living in senior citizens complexes, in nursing homes, and just by themselves, led us to believe that this tremendous amount of product which is now available is not recognized by many of the people who have needs. We would go into a senior citizens complex with several hypotheticals. We would say, "What if somebody had developed a particular device that would allow you to turn a light on and off by just touching it?"

And they would say, "Well, when that day comes I hope I can buy it, and if I don't, I hope my son would give one to me." Well, it so happened that product had been on the market for several months but no one had ever tried to target it at this person.

Well, we kept getting this message reinforced over and over again, when one sees as a business person, a tremendous unmet need by a growing population, and markets and products that are now available, one has to visualize a connection. And we're trying to make that connection.

I should say, Mr. Chairman, that while some of the products that I've demonstrated here, are not American manufactured, we still find that better than half of our products are of American manufacture. But they are typically the kind of products that the American manufacturers, like the Bennett bend knife, are not targeting at the people who really can have their needs satisfied by that message, that linkage, that we see as the business opportunity.

We'd like to serve the community, and feel we're doing so. But we feel that this is a solid business from a financial standpoint as well.

Mr. ROYBAL. Mr. Citrin, I'd like to wish you and your brother every success.

Mr. CITRIN. Thank you, Mr. Chairman.

Mr. ROYBAL. Mr. LaBuda, could you give us your definition of "technology"?

Mr. LABUDA. I think, Mr. Chairman, you've hit on one of the—maybe the opportunity but also the problem of this whole area of inquiry. I often get telephone calls and people say, "Tell me everything you know about technology and aging," and my response to that is "Which technology are we talking about? Is it health care technology, transportation technology, communications technology?" And I think some of the problems that we've experienced over the last 3 or 4 years in our effort to get business interested in product development and looking at legislation that impacts on older people is that we bring a group of persons into a room with divergent interests and views, all under the guise of talking about technology and aging, and we find that we have a real problem communicating.

And maybe one of the things that Government can get involved in is to help us begin to categorize and more closely focus the types of things that we're talking about so that when somebody calls me

and says, "Tell me what you know about health technology and aging," that we can begin to focus and explore that a little bit more in depth.

Mr. ROYBAL. In your testimony you make mention of the potential that exists for abuse. What technology are you talking about?

Mr. LABUDA. I think that probably the best example is in the area of communications technology. The Social Security System, medicare, and medicaid, almost all, if not all of that information, is now computerized. It's very likely that in the future, as banks and business and government look at ways that communications technology can make things more efficient, if older people don't learn to use that home computer which they may be able to use to access their records or find out what their status is at a certain point, what they would have to do is go to someone else to access that information. And at that point you have the potential for victimization.

Would they have to pay a fee to obtain that information? And if they did pay a fee, what guarantees are there for them in terms of the information that they might be given? Because the broker could give them all the information, part of the information, and the older person wouldn't know whether or not they had received a full accounting of what they had paid for.

So, our concern is that if there are interim steps involving technology where older people have to go to someone else, at each step there is the potential for victimization and it is something we're concerned about.

Mr ROYBAL. Dr. Furlong, again, tell me how seniors can benefit from technology. And I'm talking about seniors from 50 to—you said there was a student that was 93 years old?

Dr. FURLONG. Ninety-five.

Mr. ROYBAL. Ninety-five?

Dr. FURLONG. Yes.

Mr. ROYBAL. I missed it by 2 years. But it seems to me that in these classes that you have you probably have been able to train students from a tender age to the age of 95. How does a senior citizen benefit from all of this?

Dr. FURLONG. Well, I think Mr. LaBuda touched on it a moment ago. Seniors were no longer afraid of the technology after our classes. I think that was the most important benefit. They felt that they could manage the technology and they began to see it as a tool that could be useful for them. In terms of word processing, they saw the ability to easily edit letters. They also saw uses for data base management and telecommunications. With appropriate software, they could communicate from their home with their bank and pay bills.

So, I think the main benefit was an effective one in terms of a new attitude that seniors are able to do this. It's been 10 months since our classes and the appearance today of our seniors expresses that enthusiasm they had for computers and their level of confidence. They can run a program use a spreadsheet and write with a word processor.

So, I guess the main benefit is the application of the computer as a tool to meet the needs of seniors. And we're now faced with the problem of helping computer manufacturers and software develop-

ers think about the needs of seniors. We're convinced that they can learn.

A 95-year-old student told us, "I couldn't see and I couldn't hear, but I love what you're doing." [Laughter.]

Mr. ROYBAL. Well, Dr. Furlong, one of the things that interests me is the ability to have, via the computer, your checkbook balanced.

Dr. FURLONG. Yes.

Mr. ROYBAL. I'm an accountant by background and there are times when my checkbook doesn't balance. I find that I left out an entry or something has happened, or I didn't add correctly. In a big hurry I saw a 7 where a 9 should have been. Will that computer help me?

Dr. FURLONG. Yes, Mr. Chairman. We will have to get the appropriate software for you.

And I should mention that a primary concern to our seniors is the affordability of computers. This whole computer system you see costs $125. That is within the budget of a senior. We would have to buy the software, which would be an additional cost. There is software available to do checkbook balancing, although I'm not very successful with that on the computer myself.

Mr. ROYBAL. Now, Dr. Furlong, I would like to ask one of your students, any one of the ladies who are there, how they feel about learning to use a computer. Is there anyone in the class who may want to make a statement at this time?

If not, why don't you think about it, and then I'll ask again. Maybe you can tell the committee how you feel about it. Are you enthused? Was it difficult? Any information that you can give us from a personal standpoint. If you're prepared to do that, we'll be pleased to listen at this time.

Ms. THOMSON. I would say just off the top of my head, I'm a former teacher of mathematics and it first appealed to me from that standpoint. And then my real motivation was my grandson. He's trained with computers and is using them. And I wanted to know more about what he is learning. And I found it very stimulating.

Mr. ROYBAL. Well, was your motivation to learn computers the fact that your grandson was learning them and that you wanted to keep up with him?

Ms. THOMSON. No, I felt that it was connected to my field and I was behind in it, that I wasn't keeping up myself.

Mr. ROYBAL. Because that would be a motivation for me. I wouldn't want my little grandson and granddaughter to know more than grandpa does.

And that would be one way in which I could get into a computer class. You know, my little grandson has already started and I went to their classroom and here they sit behind these computers, and I thought that it was only my grandson who was 13 years of age. But I found out that students in the first, second, and third grades are also learning these computers. I thought this was a tremendous advance in the education system.

Unfortunately, there were only two or three computers in the whole school and not too many could take that particular class.

I asked the teacher whether the students were selected because of grades and so forth and she said no. They make no application. And we take first come, first served. So it wasn't because someone was very good in arithmetic or anything of that kind. This is why I was asking about your class from 5 years of age to 93 years of age.

Dr. FURLONG. Right.

Mr. ROYBAL. That is a tremendous span in which these computers can be so useful.

The Chair now recognizes Mrs. Schneider.

Mrs. SCHNEIDER. Thank you, Mr. Chairman. Let me commend you for bringing together this very interesting hearing, and the good work of the staff in selecting the people to testify, because I think that so far we have a pretty well-rounded view of what there is to make available to seniors to facilitate some of their everyday tasks.

[The prepared statement of Representative Claudine Schneider follows:]

PREPARED STATEMENT OF REPRESENTATIVE CLAUDINE SCHNEIDER

Mr. Chairman, I congratulate you for your wisdom and foresight in holding this morning's hearing on the increasing link between high technology and the lives of senior citizens. While the relationship between the nation's gradually aging population and its technological advancements may not be self-evident, I feel confident that many of the technologies spoken of and speculated about today will indeed become tomorrow's reality.

Projections tell us that by the year 2025, the proportion of the United States population over the age of sixty-five will be double what it is today. This increasingly elderly population, however, will be a good deal different from past and present senior citizens. In large part they will be less dependent on extended family-care, more highly educated and generally healthier. With this in mind, tomorrow's seniors are more apt to remain independent for a longer period of time and remain as mobile and intellectually active as long as possible.

An adaptive society willing to meet the challenge of the information age will enable tomorrow's seniors to live the kinds of lives they are accustomed to and prefer. A myriad of computer systems are already being experimented with which, according to most accounts, conclusively link computer technology with the enrichment of senior citizen's lives—physically, emotionally and academically. For instance, there are serveral computer "networks" being tested by cable and broadcasting companies which help incapacitated or lonely seniors communicate with one another for support, information exchange, game playing and educational purposes. So-called "electronic universities", for instance, are being established for those elderly persons unable to attend a traditional college or university setting. Moreover, computers are beginning to assist seniors with their shopping, banking and other activities made difficult by physical or emotional impairment.

Computers, however, are just one tool being examined when considering the adaptation of information age technology to the lives of senior citizens. New technologies can and must be devised to assist the homebound senior and, equally as important, the senior who by virtue of some minor age-related limitations can no longer reach the top shelf at the supermarket or stoop for the lowest book at the public library. While there are several developing technologies on the drawing board, there is a long road ahead before society fully understands the pervasive influence that technology can have in promoting self-sufficiency and self-fulfillment in the lives of seniors. Today's hearing is a first step in heightening public awareness and I commend the committee for the instructive initiative.

Mrs. Schneider. I am interested, Mr. Citrin, in whether or not you see any viable role for the National Association of Manufacturers and the chamber of commerce insofar as marketing products for such usage?

Mr. CITRIN. Well, I think, Mrs. Schneider, that one of the most important roles that organizations of that type could play would be

in the dissemination of information. Some of the material that I referred to earlier is tremendously forceful. The pamphlet, "Can Your Company Afford to Ignore a Major Untapped Market?" This is the kind of material that ought to be coming out from the National Association of Manufacturers, et cetera.

It's coming out from organizations like the ones represented here at this table and the gerontological organizations. They're doing a tremendous service by putting together this information.

This dissemination of information is important.

It seems to me the other related role that could be played would be to somehow help, through conferences, seminars, materials, to orient American marketing to the psychology of older people. We have seen a number of articles in some of the trade publications dealing with advertising and marketing, retailing, about the older American market, and some beginnings of attempts to, for instance, feature older people on television commercials, using products.

But there still seems to be a nervousness and a hesitancy by American business in trying to direct itself at this market. And the associations could do an awful lot to hold conferences, seminars, to educate American business into the sociological aspects of older people, as well as the hard data that will prove the fact that the market makes sense from a business standpoint.

Mrs. SCHNEIDER. You say that work is being done by organizations such as are gathered here today. But I guess I find it difficult to understand why that interfacing isn't taking place. What is to stop you, Mr. LaBuda, from taking a pamphlet of that type and going to the National Chamber of Commerce and suggesting that they do what Mr. Citrin suggests, of setting up conferences and having—you know, we've had so many different months of the elderly, year of the elderly, and really taking it seriously so that we can better penetrate some of the opportunities and the market that is available there.

Mr. LABUDA. Those two pamphletes are the result of an AOA funded conference 3 years ago, cosponsored by the Gerontological Society of America and the Western Gerontological Society. I think some of the things that came out of that conference point to the problems that you're looking at.

We brought together representatives of business, CEO's, heads of research and development units in companies, together with older people and gerontologists, to address potential markets for products for older people. What we discovered over that 3-day period was a real language problem. Gerontologists and human service providers understand the needs but it's very difficult for them to translate those needs into specific product requests.

For a large part these people do not have business backgrounds and do not understand the perspective from which business needs to approach the development of products. Many of the low-cost aids which we're very much aware exist, as was pointed out, are not marketed to the general public and the development of new products requires a tremendous amount of capital up front and there's a nervousness on the part of business that the older market is not large enough and affluent enough and interested enough to support the sale of those products so that company is going to see a return.

There is, to some extent, historically, a suspicion on the part of gerontologists and human service providers in respect to business, that they're out to make a profit and that that, therefore, negates any social responsibility. That's something that we need to get over.

Another thing that has occurred in the past few years, there is a segment of the elderly in this country who very definitely are in need of assistance, Government assistance, they're below the poverty line, they don't have access to jobs, they have physical limitations. So, we who are gerontologists and human service providers, because of identifying that need, have done a really good job of selling this country on the fact that the older population is poor, that it doesn't have dollars to spend on products, and now what we're doing is going back to business and saying, "No, wait a minute, that isn't exactly the way it is." There are some who need that help. But for most of them, they have discretionary dollars and they are a market.

So, we have a long way to go here on sort of turning around some stereotypes that have been created. For business coming into that environment, they're coming at it from a perspective, and that comes down to dollars and cents, of how much money does it take to produce this product, how long is it going to take us to get it on the market, what is our return going to be, and so they have trouble communicating their needs to gerontologists and human service providers.

So, I would say with the production of those pamphlets and in the last 3 years I think it's significant that this hearing is happening, and that there are both representatives of the human service and the business sector here together, talking to you about how can we do this. So, I think we're on the way; we just have a ways to go.

Mrs. SCHNEIDER. Well, it certainly has inspired me to hold a hearing in my own district, where I could bring together these parties. But I think that would be helping, at least in a small, little corner of Rhode Island, to perhaps move the Nation—Rhode Island's always looking to figure out how we can move the rest of the Nation. So, we could give that a try.

Mr. Citrin, I really am very curious as to exactly how you're going to do what you're going to do. Now, would you be giving away a trade secret? It sounds so very progressive and innovative and really on the cutting edge of something new and exciting. Are we concerned that there are too many competitors tuning in right now to give the details of how you're going to accomplish what you're setting about?

Mr. CITRIN. No. I think I closed my remarks by saying we hope we would become a model. We'd like to be a little bit ahead but we'd very much like to have others follow, and expect it. It will show that we were successful.

But in terms of the details, the key element is manstreaming. After having assembled the products. We have competed the assembling of 750 products, although that's obviously a continuing process. We've now set up communications links with about 300 suppliers, some of them overseas, some of them here various research and development institutes, so that we can at least keep abreast of new products coming onstream.

Then the question is, how best to market them? We're going to have a multiplicity of methods. We're going to have a buyer's guide which will feature all of the products but it will look a little different from the traditional aids catalog which one has seen in the past which are oriented primarily to professionals, occupational therapists, et cetera.

But neither will it be as slick and glossy as the typical mail order catalog. It will have some very hard and clear facts on each of our products and what their capability extending features are, and what kinds of people might benefit the most from them. That buyer's guide will be disseminated as broadly as we can disseminate it, to consumers and to professionals.

We're going to have the beginning of a more—I should say "traditional" but it's still a modern method of marketing, mail order catalog, which will try to reach not just older people, but the population in general, because we feel that for every older person there is at least another person and probably a half a dozen who buy for the older person.

Mrs. SCHNEIDER. Right.

Mr. CITRIN. So, it's the general population we're talking about. We want to do some regular mail order marketing. And then we see a combination of different types of retail establishments, some free standing, some a department within a store, whether it's a general store, a department store, a drug store, or whatever. These would be franchise dealers who may be exclusively Ways and Means dealers or may be a Ways and Means dealer, as part of a larger retailing enterprise.

Our hope is to have, for instance, in every small town, whether it's the general store or the downtown drug store, a Ways and Means department in that store, which features these products, but not just the products, because along with them will go a package of marketing materials.

This calculator can't just sit there like it does in the office supply store, with 15 others.

Mrs. SCHNEIDER. Right.

Mr. CITRIN. It has to be there with a clearly worded placard or picture emphasizing that it has big buttons, no tiny switches, big numbers. So that it takes a little more space to display these products, but we feel that's absolutely essential in order to focus. And then there has to be some training for the people working in the store, or managing the store, and this training program is another part of the package that we're putting together.

Mrs. SCHNEIDER. Are you going to have some kind of feedback mechanism, for example in the back of your buyer's guide, something that might say, "If you have enjoyed any of these products or you are seeking a product that does not—is not included in this catalogue—" are you going to make this more of a two-way street?

Mr. CITRIN. Absolutely. We are going to have the open invitation expressed in print and wherever we speak, to groups, and we speak to a lot of groups these days, to bring us suggestions. We also see a dimension that I really didn't mention, and that is that the proof of the solidity and the viability of this kind of marketing and this kind of marketing focus, is what we feel will free up an awful lot of

products that are now on paper, in design stage, but haven't been put into production.

We already have several of those ready to put into production. We're not going to manufacture them. We will have others manufacture them for us, as soon as we can evidence the fact that the market is there. And ideas and suggestions from people who use or would use products are definitely going to be part of our mode of operation.

Mrs. SCHNEIDER. Great. My final question to you is how soon might I be able to get a copy of your buyer's guide?

Mr. CITRIN. This summer, Mrs. Schneider.

Mrs. SCHNEIDER. Yay. Good. I have a 78-year old aunt who has a birthday this August and I am desperate.

Mr. CITRIN. I will be sure to send you the first copy.

Mrs. SCHNEIDER. I'll be looking forward to it.

I would like to throw this question open to all of you, just very briefly. We mentioned the various opportunities here and we're talking about the older population as consumers. And yet we recognize their limited financial resources. How are we going to grapple with that? For the most part a lot of what we're talking about here is costly, and when you look at the poverty level the majority of people on the poverty level, two out of three, happen to be women, and of those the majority of them also happen to be elderly. Now, granted, there are a lot of good ideas and not only good ideas that might bring some luxury to people's lives, but also might mean the difference between suffering and not suffering, and how are we going to be able to provide some of these ideas rapidly enough, given the limited resources of the elderly?

Mr. LABUDA. If I could respond to that. First, for the past 2 years the Western Gerontological Society and now in conjunction with AARP, has been taking a look at low cost, low tech items that could make life easier for older persons. And we're not talking about severely disabled older persons, but moderate income older persons who may be suffering some limited physical or sensory limitations.

And what we discovered is that there are probably between 12,000 and 15,000 of these products currently available, but the general public, as a whole, is unaware of their existence. And we are attempting, through a similar kind of guide, which we'll be publishing in January or February of next year, to bring to public attention that these things exist. And they're not the exotic technologies that you see before us. But they're things like the reacher and the calculator, and the plate, those items may be a little bit more expensive but the majority of the 400 items that we're going to be highlighting will be under $10.

Mrs. SCHNEIDER. That's very exciting. Good.

Mr. LABUDA. It's there. It's just not widely known. And a lot of them are not expensive. They are low cost, more simple technologies. But they are very effective.

Mrs. SCHNEIDER. One of the best products, if I might just share with you, that I have recently purchased for my elderly aunt, happens to be a little computer that attaches to the telephone, where you can predial many of the different phone numbers. And I have thought, since she is living all alone, if she is ever in a hurry to

call the police, or some emergency number, she more likely than not would get flustered and not be able to even dial, and this way she can just push that button. And I think that that's one of the most imaginative developments, not just for the busy middle-aged working man or woman, but for the elderly. I think it's a real godsend.

That's all I have, Mr. Chairman. Thank you.

Ms. ENGELHARDT. Mrs. Schneider?

Mrs. SCHNEIDER. Yes?

Ms. ENGELHARDT. May I address that from the point of view of high technology and some of the things we're doing? Because I'm afraid too often high technology comes away with a very bad reputation as only being very expensive.

I think we have to start looking at the same kind of issues that we're looking at with the Veterans' Administration/Stanford University system, and that is developing general purpose assistive devices so that we can, indeed, do as Mr. Roybal suggested at the beginning, develop something that we would all want, or that some of us would want, and then we're dealing with economies of scale, let me give you one example.

For instance, a voice technology that is in a toy right now, it's called a Speak 'n Spell. I was just recently working with a young man who has never spoken in his life, because he has cerebral palsy. He uses a Speak 'n Spell with his toes in order to communicate with me. I think the Speak 'n Spell costs less than $50. I'm not sure of the exact price.

But you're talking about a piece of high technology, very high technology, that's been incorporated into a toy that is now sold for less than $50, and it's providing communications to a human being who has never in his life been able to express in a vocal way one of his wishes or desires.

High technology should also connote high simplicity. Our television sets that we use are often more complex technology than these robots we're talking about today. And yet all of us can use them. It's a design issue.

Mr. ROYBAL. Ms. Engelhardt, you demonstrated various robots of different shapes, each designed to perform a specific function. For example, one of the robots can give you a drink of water and salt your food, and even dances for you.

Now, they're all robots. Can you give us your definition of a robot?

Ms. ENGELHARDT. My definition of a robot is a useful tool for humans. Now, you're going to find a lot of other definitions in the literature, and one of our problems with trying to give you any hard data on numbers of robots in the United States, or in Japan, evolves from the fact that we have not clearly defined what a robot is.

Joe Engelberger says it's a robot if you say it's a robot. They range from toys all the way up to the sophisticated system that you're seeing over here, which is an interactive robot.

But I personally define them as, "systems that can serve human beings in a safe and useful manner."

Mr. ROYBAL. In these systems that serve human beings, you mention the fact that there are certain spinoffs of technology that do exist. What did you mean by that?

Ms. ENGELHARDT. OK. This ties in very well with what Mrs. Schneider was saying, because let me give you a good example of something we've worked on. You mentioned the little computer that you could get that would dial ahead. That same idea can be hooked into what is called emergency alert systems. Now, they come under various names, such as Lifeline and other names.

But it's actually a pushbutton, a help button that people wear around their neck or on their wrist This button when pushed, connects them immediately to a care center, a medical center of some sort. Now here, again, I can't be specific, because some are hooked into emergency rooms; some have freestanding units where they dial an emergency number or a neighbor to come and contact them.

At Stanford University we are just initiating this, and I am just buying one for my mother and it should cost about $15 a month to allow me the freedom of being able to know that my mother has a button at her disposal every instant of the day and night, in case she needs help and I'm not there available.

Now, I also mentioned to you some voice technology. The list goes on.

We have a wheelchair that we just developed out of our center that's based on robot technology. The wheels are in a base that is called an omnidirectional base; it pivots and spins and can move in any direction, it overcomes the bulkiness and the limitations of just backward and forward movements that are characteristic of the wheelchairs that are on the market right now.

Now, this same kind of technology started to be used in the development of the robot. But it's a spinoff now, and, as a matter of fact, it's been taken up by a manufacturing company to produce and disseminate this kind of technology.

I think it's going to have enormous applications for older people because it's going to be so simple to use. And it's going to sell in the same price range as other electric wheelchairs. It's just a reinvention of the wheel.

Mr. ROYBAL. We have testimony before this committee from senior citizen groups that they took more pills than they should have because they forgot the time that they were to take it or the number of pills and so forth, and we found that that seemed to be a problem only for senior citizens but anyone who must take medication or prescribed drugs. But nevertheless, we were talking about the senior citizen community at that particular time.

Can you tell us how technology might benefit health care personnel and perhaps how it can benefit social service providers?

Ms. ENGELHART. If you look at the kinds of tasks we have identified, it's very rich in the kind of tasks that might be developed to help personnel. One of the big areas, I think, happens to be in lifting. Another big area happens to be in monitoring. Another, kind of tying in here again to your spinoff technology idea—one of the ideas is the need for monitoring devices not only in hospitals but in nursing homes. This same kind of monitoring device might be needed on a soldier that would be lost in a bombing and it might

be needed on a child that was on a playground. So, it's a widespread use of an idea—that if you had a little monitoring device that could pinpoint a person's location—a child on a school ground, a soldier in a danger area, or an older person within a long-term health care setting.

Now, I think one of the most exciting things about robot technology is that when we were working with the nurses in the nursing home, they were very excited about and they kept telling us it was critically needed. And I know, in particular, when I was with Upjohn, some of our older nurses ended up not being able to stay on the job as long because of the lifting constraint. Lifting is a very critical part to personal care in any kind of health care setting, in home or in a long-term care setting.

If we could develop types of technology that would allow patients to lift themselves, to be in voice control of a lifting device for themselves. So they could say "Up," "A little to the right," "A little to the left," "Move me down slowly." Then they are in control. And also, the older nurse may, indeed, be able to stay on the job longer because that would be one constraint on her job description that would no longer be needed. She would have the technology to assist her in that area.

Let me say a little bit about the cognitive problems we are dealing with because this is probably one of the most exciting new areas of technology. We are working on it at our center and the idea of cognitive rehabilitation is absolutely a thrilling idea.

We mentioned that we are using computers for children. You mentioned your grandchildren were age 5. I have a godchild age 5 for whom we just bought a computer. Now we are talking about learning for children. I get excited, from a neuroscientist's point of view, about the idea of relearning for adults. What about stroke patients? We don't know what we might be able to do with stroke patients using this kind of technology—what if we had physical environments and visual environments to try to retrain, and then let a very patient computer work with them time after time.

What about retraining older persons in their mathematical skills? We talk about children, that we can use a TOPO robot to and teach them geometry. What about a stroke patient who has lost that ability—the visio-spacial ability? We just don't know.

I have been asked by NASA and the Veterans' Administration to head up a project that will develop a memory aid. I am calling it a mindjogger, because I need it myself often times. So I am not developing it just for elderly. Again, economies of scale. If we start at the front end talking about how we use this technology and design it for people and needs. We will find a wider market. We are looking at retarded children who have the same short-term memory deficits as elderly people who have beginning Alzheimers also, some of the short-term memory needs I myself have every day of the week in just remembering a telephone number, could be addressed by this same kind of a technological solution.

Mr. ROYBAL. Thank you, Ms. Engelhardt. May I, on behalf of the committee, thank each of the witnesses for very excellent testimony. Unfortunately, we do not have the time necessary to question the witnesses further, but I would like to make request, if it is possible, for this to be done, Dr. Furlong, and that is that the students

who are here, prepare a statement that is no longer than 5 minutes in reading time, telling the committee what they think about computers and also telling us what it is that we left out in the questioning of the witnesses. I think that the committee can learn a great deal from their imput. And, if any mistakes were made, if anything was left out, they can tell us and we can make sure it will not happen again. In that manner they will participate in this hearing and not only that, they will be able to provide us with very much needed information.

Dr. Furlong, can that be done?

Dr. FURLONG. I will have to consult with the students, but I think we can do that.

Mr. ROYBAL. Very good. I would hope that they would be willing to do a thing like that for us.

May I thank the witnesses for excellent testimony.

The next panel is made of Martin Faletti and Arthur Shostak.

Mr. ROYBAL. Dr. Faletti, would you start off the discussion?

PANEL TWO, CONSISTING OF MARTIN FALETTI, DIRECTOR RESEARCH DIVISION OF THE STEIN GERONTOLOGICAL INSTITUTE, DIVISION OF THE MIAMI JEWISH HOME AND HOSPITAL FOR THE AGED, MIAMI, FL; ARTHUR B. SHOSTAK, PROFESSOR, DEPARTMENT OF PSYCHOLOGY AND SOCIOLOGY, DREXEL UNIVERSITY, PHILADELPHIA, PA

STATEMENT OF MARTIN FALETTI

Dr. FALETTI. Yes. Mr. Chairman and members of the committee, my name is Martin Faletti and I am director of the research division of the Stein Gerontological Institute Division of the Miami Jewish Home and Hospital for the Aged in Miami, FL.

Briefly, as a researcher, I clearly come out of a center which is a multilevel geriatric care facility. Our services encompass nursing homes, congregate housing, outpatient health and mental health centers. We are one of the sites for the channeling long-term care demonstration project and the organization, through the Stein Institute, has a commitment to research and training in service of better long-term care and service delivery for the older adult.

I am going to select aspects of my written testimony in interest of what has been said before.

Mr. ROYBAL. Your testimony will appear in the record in its entirety. You may summarize.

Dr. FALETTI. Since some of the points that I have made have very well summarized by others, there are a few points that I would like to emphasize, particularly as one who has been engaged in the last 3 years in ergonomics research with the older adult, primarily focusing on the ability to do tasks in daily living. I would like to frame my remarks about my results today around three major points which are outlined at the beginning of my written testimony.

I think, first, as you probably heard, the ability to perform daily tasks and activities—those mundane things we have been talking about—reaching for items in the kitchen, cooking, being able to go out shopping, accomplish personal care are probably one of the major threats to independence as we go into advancing age. If you

talk to anybody in the long-term care business, more and more we see frailty in activities of daily living, perhaps accompanied by early onset dementia, as one of the primary reasons the older person fears, or has to give up independence either by getting services in the community, going to semidependent housing or entering the nursing home.

It has been the view of many, and I share it and our research has reflected and, in some cases, is beginning to develop support for this that the problem, in many cases, with functional problems in daily activities is not so much those changes with aging that will happen to all of us as we go on and on into advancing age—not those per se—but rather the change in those capabilities as they relate to what the environments that we have constructed for ourselves demand.

To some extent, I think, most human factors engineers and ergnomic engineers will tell you that in a lot of our product design and construction, we have a sort of middle aged bias. We design for us when we are 25 through 45 and, as a result, we base a lot of the things that we have to work with—the size of cups, the size of containers that we can lift—on the fact that we have certain strengths, capabilities, and visual acuities at those ages. And yet, we would not consider our children handicapped yet we do a large amount of ergnomic engineering, safety engineering such as cut down chairs in order to scale a whole world for ourselves on the early end of our developmental continuum.

We wouldn't consider the original seven Mercury astronauts impaired, and yet a tremendous amount of human factors engineering went into reconciling the capabilities of those individuals with the excessively high demands of their environment—onboard computers to help them do tasks faster; life support systems to help them breathe, eliminate, and eat.

That's how we began our research program—with the notion that we could do a lot better job in designing—redesigning—the existing environment to be an age-responsive life support system for us—or if you will, a functional support system for us—much farther into advancing age than has been the case.

In our work, supported by the National Institute on Aging, we essentially took the same approach taken in many human factors studies and began by asking about the kinds of tasks that older people have to perform. We actually go into environments to videotape and record what it is someone has to go through to make a meal; what it is, biomechanically, in terms of motions and forces they have to do, to get in and out of a tub or to get to the grocery store or to use one of the pushcarts as it continually fills up with groceries.

I guess the major message that I would like to deliver and reemphasize, as has been emphasized here before, is that we are talking about bridging the gap between ourselves in advancing age and the environment as we have constructed it. To some extent, it is what we do in disability and rehabilitation engineering, but I should like to emphasize that, from our data, it is not simply a matter of applying or making more esthetic items which we originally created for a specific handicap or disability and saying, "Those, if they are more esthetic in appeal, can be imminently used by all of our older

people." What happens to us in aging is going to be sometimes different than a specific disability.

I will give you two examples. We use a great deal of grab bars in all of our facilities for older adults and that has been a time-honored technology for those who are confined to wheelchairs or limited in their abilitiy to stand or move about. And yet, if I am a 28-year-old vet, I have a tremendous amount of upper torso strength. I have a lot of strength in my arms and I can pull myself around in position. If I am an 80-year-old man whose aging has taken the same toll on the upper part of my body as the lower part of my body, I may need a different type of technology. When we look at the tasks people have to perform and the capabilities that change in advancing age, what we find is that sometimes we need to think about the technologies we have and adapt them in a little different way. The grab bar may help with positioning, but the voice control seatlift may be a better solution for some older people who need to be able to get in and out of a tub.

The other example comes out of our work with meal preparation. We have long emphasized in many tasks the reaching and bending aspects of the kitchen, the remote grabbers and these sorts of things, because that seemed to be a problem that people talked about—the shelf—and yet, we looked at what they do on videotape and 80 percent of it is standing at a counter manipulating objects. The battle for independence in making a meal looks to us to be largely a matter of the elbows down. The range of products and devices that are available to help us manipulate things better has only recently gotten the attention that we have given to lower cabinets and better shelves and counters.

So, to some extent, from our perspective, our research has focused on trying to do task analysis potentially to help Mr. Citrin and other people like him to provide the data to the K. G. Engelharts and the other people interested in adapting robotics technologies to spell out, "What is the nature of the gap and how does it get bigger with advancing age or does it get bigger with advancing age and in what particular areas?"

There are several areas, particularly in the area of cognitive functioning where we look at the task to be performed and how one begins to remember and be able to orient to one's environment and what we find in the voice technology is very exciting. We feel that perhaps the person's existing apartment, using a bar code reader on the order of a Texas Instruments "Speak and Spell" could actually be coded to help that individual with an onboard Speak and Spell to constantly remind them verbally, "You're in the living room on the way to the kitchen." Talking controls on the oven—a little voice chip in the oven control are exciting because every subject we have ever run in an ergnomics study admitted to having left the oven on or left the stove on unattended for long periods of time—clearly a safety hazard. The investment in a secondary device to provide a little better cue than some of the little red lights that sometimes we can't even see seems to us from our research to look like a very good investment.

Why do we talk about these things? I think the main reason for those of us in long-term care is that we are looking at technological alternatives to our existing continuum of care. And when I say "al-

ternatives," I will go to my last point which is not high tech or high touch, but high tech and high touch.

In many cases, much of what we do—have to do—in community services is to provide functional support to people who need it in their community settings and, clearly, we want to keep them in their homes and apartments for as long as possible. We see the use of technology, when adapted to specific tasks and activities and particular, specific problems that people are having, as a way of better targeting technological and human resources to the problems they are best able to help with. Perhaps if it's just a matter of some pots and pans, stove controls, and a few minor devices, maybe we can free up that homemaker for a much more needy case that all of us who are in these service programs know we have on waiting.

So, we see the hopes of the panelists who have gone before and are trying in our research to point the way and say, "Here are places where your technology can fundamentally impact how we do long-term care and support in community settings and perhaps enhance the quality of life for a wide range of older individuals having particular levels of need.

Mr. Chairman, thank you for the opportunity to testify today.

[The prepared statement of Dr. Faletti follows:]

PREPARED STATEMENT OF MARTIN V. FALETTI, PH.D., DIRECTOR, RESEARCH DIVISION, STEIN GERONTOLOGICAL INSTITUTE, MIAMI JEWISH HOME AND HOSPITAL FOR THE AGED

TECHNOLOGICAL SUPPORTS IN ACTIVITIES OF DAILY LIVING (ADL)

Mr. Chairman and members of the Committee, my name is Martin Faletti. I am Director of the Research Division of the Stein Gerontological Institute, a division of the Miami Jewish Home and Hospital for the Aged at Douglas Gardens in Miami, Florida. The Miami Jewish Home and Hospital is multi-specialty geriatric care center which encompasses nursing home and congregate living facilities, day and community care centers, outpatient health and mental health centers, a channeling long term care program, and, through the Stein Institute, a committment to research and teaching aimed at improving the quality of long term care service delivery.

I am speaking to you today on roles for technology in extending independence and quality of life in advancing age because of our research and applications test experience in this area over the past three years. My discussion focuses on factors which affect the ability to function in advancing age and how technology, from can openers to computers, might be applied to extend and enhance functional ability and independence with respect to daily tasks and activities. Specifically, our experience leads me to focus on three major points:

First, problems in performing daily tasks and activities in existing home and community environments are a major threat to the older person's independence and quality of life.

Second, many of these problems can be traced to a middle aged bias in designs for spaces, products and devices so critical to accomplishing daily activities without assistance. Our research, applying human factors engineering approaches to problems in daily living, supports other work which has suggested that problems in daily task performance are often the result of the gap between demands for action implicit in the way we design our home and community environments and the capabilities which we bring to those environments in advancing age. The issue is definitely not one of the older person as handicapped; rather it is more a matter of better products and devices which recognize our adaptive capabilities in aging.

Third, our results suggest that many of these gaps can be bridged by technology and devices; thus allowing the person of advanced age with reduced capabilities to still use the existing home and community environment to successfully perform many daily tasks rather than rely solely on community services or residential care for assistance. My discussion today includes illustrations of some devices which can

bridge gaps we know about; as well as areas where work and effort is needed to realize the potential of this alternative to extending function into older age.

FUNCTIONAL IMPAIRMENT: A GAP BETWEEN PERSON AND ENVIRONMENT

We face the prospect of increasing numbers of persons living into more advanced age (Taeuber, 1983). Given evidence that advancing age is associated with a greater likelihood of experiencing physical and/or mental changes (Saxon and Etten, 1978) which give rise to more frequent needs for care and support with daily tasks and activities (NCHS, 1983), we can clearly benefit from any new alternative approaches which can potentially meet these growing needs in the older person's own existing home and community.

The inability to perform daily activities such as shopping, cooking meals, cleaning the home, and personal care and hygiene tasks has major implications for one's ability to continue to live independently in a community setting and, indeed, is a major factor in the decision to provide community services or relocate the older individual to a more supportive setting (e.g., group home or nursing home). While it is true that age associated changes in physical and/or mental capabilities affect our ability to move about, lift objects, or accomplish tasks involving manipulative skills and fine touch, work in gerontology and human factors engineering indicates that the ability to independently perform any particular task is a function of the degree to which the person performing the task has the capabilities (e.g., visual acuity, lifting strength, fine motor control) to meet the demands for such activities which are implicit in the design of the spaces, objects and devices in the physical environment. For example, if I (1) need to open a can of food in order to make a meal and (2) the can opener I have requires 8 pounds of compression force to drive the blade through the can top and (3) I am able, because of muscle mass loss or arthritis, to apply only 5 pounds of compression force, then I am likely have difficulty in accomplishing this task.

We can, at this point, say that I am too weak or frail to open cans (or walk to the store, or get in and out of a bathtub) and thus focus on me and my advancing age as the problem. We can also say, as a human factors or rehabilitation engineer might, that the can opener is poorly designed for me as a user and, with the addition of a cam, might allow my 5 pounds of compression force to be magnified to an effective 8 pounds at the blade, thus opening the can. Notice that we have not changed my capability—I still have 5 pounds of force—but have used a technology, cams and levers, to translate my force and magnify its effectiveness in accomplishing the task.

Our work in this area, supported by the National Institute on Aging, has applied human factors engineering research techniques to task analysis of daily activities as means of analyzing the gaps between the older person's capabilities and the demands of the existing environment. We find, as others have suggested, that furnishings, consumer products, and devices used in daily living are, for the most part, designed around standards based on a general, or younger population, and thus can demand types and/or levels of physical or mental capability which exceed those which we are likely to have in advancing age. By measuring these demands and the corresponding capabilities in samples of older adults, we are beginning to specify the nature and extent of the gaps between the older person and the environment as it exists in a way which provides information which design engineers can use to adapt or develop technologies to bridge the gaps. Clearly, one must know the width of the river or canyon before one designs and builds a bridge.

Thus, for us, the central question is not what the older individual can no longer accomplish relative to younger age groups (all of us will experience some losses) but rather what capabilities this person still possesses, how these fit with task demands in the home and community environment, and what devices or modifications to the existing environment might allow those with reduced capabilities to still meet task demands.

SEPARATING FUNCTIONAL PROBLEMS FROM DISABILITY: THE ELDERLY ARE NOT THE HANDICAPPED

The use of devices and modifications to existing physical environments as a way to improve the daily functioning of persons with reduced capabilities is certainly not novel. Occupational therapy and rehabilitation engineering have made significant progress in developing a range of devices and adaptations to the physical environment designed to address functional problems associated with specific disabilities (e.g., loss of a limb, neurological insult, or neuromuscular dysfunction). While impaired function in ADLs is a common outcome of both a specific disability as well as the often multiple and gradual reductions in capabilities experienced in advancing

age, we should be careful about assuming, because of this apparent similarity, that disability oriented technologies can directly address most problems experienced by older persons.

First, many devices aimed at specific disabilities are designed to develop and/or trade on compensatory abilities which a specifically disabled person may retain but which an older adult may not. For example, an older person requiring a wheel chair because of gradual loss of muscle mass (occurring over the whole body) may not be able to effectively use grab bars and similar aids requiring strength in the upper body and arms which younger persons with specific lower body disabilities are able to develop. Second, many older persons who experience problems in accomplishing daily tasks in homes as presently designed are NOT specifically handicapped or disabled. As a result, they often reject a disability approach to their problem and this lack of user acceptance minimizes the impact of adaptive technologies. While more hard data on personal capabilities and environment demands are needed, it is possible to briefly consider some other ADL areas where the gap between changing capabilities and environment demands might be bridged to extend independence, and quality of life, into advancing age.

AGE-RESPONSIVE ENVIRONMENTS FOR DAILY LIVING

Viewed from the task analytic perspective in our research, the community environment presents a range of demands for physical and mental capabilities required to accomplish activities in daily living (ADL). Demands for physical activity are readily recognized in a number of activities. Providing for nutrition involves access and transport of goods to the home, menu selection, preparation of meals, and consumption of meals. Transport of goods to the residence often requires lifting and carrying weight; a demand which can be, and often is, alleviated by the use of a wheeled cart. However, distances and obstacles between the residence and stores often require significant strength and stamina to use such a cart. While the use of computer technology can, given a delivery system, allow shopping from home, a small powered cart operated with existing remote or voice commanded control technology can allow one to make trips outside the residence, often an important source of social contact, for the purpose of shopping.

Accessing goods from storage shelves in stores and kitchens demands major changes in posture (reaching up and bending down). For example, the lower shelf in most kitchens is 6" from the floor and high shelves are about 72". While remote grip devices can grab an object out of reach, they often require considerable arm strength to support the object until it is placed on a surface. Add-on shelves which swing up (or down) and are capable of being mounted within existing cabinets could bring the shelf and its contents to the older user for easier location and retrieval of objects. Spring loading could reduce the force required to operate such a shelf.

A majority of manipulative tasks in meal preparation (e.g., cutting, chopping) involve coordinated action and/or exertion of force; often taxing the strength and dexterity of the aging hand. While convenience foods can moderate these demands, the types of packaging used with many such products may not aid but rather, degrade a situation. The boiler bag, for example, is a difficult technology to use; forcing the person to handle a hot item while trying to open it and remove contents. There are presently add-on handle type devices for boxes and jars which allow for easier handling. A hand held electric can opener which does not, as do standard models, require the lifting and positioning of the item to be opened is more usable for many older adults. While new shelf stable, minimum preparation food systems (e.g., Rhodes, 1977) are one option, the collection and use of human performance data on older users in designing product packaging to make opening and resealing easier as well as improving general handling characteristics would help; as would improved engineering of mechanical devices, such as the can opener above, to require less force and provide greater cushioning at the point where hand pressure is applied.

Personal care tasks include bathing, grooming, dressing, and use of the bathroom. Bathtubs and even some showers require stepping over bariers, often where footing is unsure. This has been an area of long standing concern and a range of add-on chair lifts to assist the person in and out of tubs have been developed. Grab bars are also used though these probably help more with balance than actual movement of the body because they require upper arm strength which many older users may not have. There are also a range of devices currently targeted to specific personal care tasks (e.g., long handled combs, brushes, dressing sticks; Breur, 1982). In addition, clothes hanger bars placed at a lower height would provide more ready access to clothes for older users and velcro closures on clothes can minimize manipulative demands of tasks involving buttons and zippers. Using a bath towel for drying the

body also requires postural change; reaching and bending to contact all parts of the body. While sitting makes the task easier, it seems possible that an air dryer with a large enough flow to dry the body would only require some standing movement rather than difficult, and risky, changes in posture.

Getting in/out of bed involves major changes in posture (i.e., lying to sitting to standing). Because grab bars and trapeze devices may again require arm strength beyond the capability of any older adults, a bed which which could raise the upper part of the body would assist in bed transfers. A more radical approach might employ a contoured bed/chair (e.g., an adaptation of acceleration couch design) which would be entered/exited like a chair and then recline back for sleep. Contouring might provide better suport for the aging body in addition to minimizing entry and exit problems.

Cleaning/maintenance of the dwelling includes heavy cleaning of floors, walls and work surfaces as well as laundry and waste disposal. Improved surfacing materials which are more easily cleaned and resistant to soil could reduce demands for bending and scrubbing. Easily disassembled appliances (i.e., toaster ovens, refrigerator shelves) could minimize physical force and activity required to clean and maintain these devies. Small, multi-purpose vaccuum cleaners which are light in weight, work on all surfaces, and are easily stored can reduce the bending and carrying required by many current models. In general, any features of the task environment which require dexterity, postural change, and weight transport are areas where technology can reduce demands on physical capabilities most likely to be impacted upon by advanced age.

While providing support for sensory and cognitive functions is more difficult, approaches using voice synthesizer technology offer promise. Auditory stimulation is a more intrusive stimulation and does not need the person to attend to the source of the information in quite the same way that vision requires. For example, many subjects in the meal preparation study admitted to instances where a stove control was on and the light was not noticed or forgotten about. An add-on "talking control" to provide auditory feedback for oven and stove controls would provide a more intrusive cue as to the status of these devices.

As we increasingly confront the problem of cognitive disorientation as a source of functional problems, one approach we are exploring envisions a system designed to provide orienting information relevant to that part of the environment via microprocessor actuated voice synthesis. The system would require only a basic physical motion from the user (e.g., using a bar code reader) and be cued by the user's movement through, and use of, the environment; in effect extending the talking control to a "vocal" or "talking" environment. While much more task analysis work with ADLs confronts us in even developing a first approach to such a system, it could be of use in cases of mild to perhaps moderate disclentation. In a sense, the technology is designed to mimic some of what we do now; reminding ourselves and repeating information slowly to assist with information processing.

TECHNOLOGY AND THE CONTINUUM OF CARE: HIGH TECH AND HIGH TOUCH

These and other possible uses of technology and engineering at all levels to develop more assistive environments with respect to ADLs do not, and should not, imply either an exclusive attention to high technology or a complete substitution of technology in place of human services. Those concerned with development and application of technology increasingly use the term "appropriate technology" to emphasize technological complexity at the level of the problem, not for the sake of complexity. One type of manual can opener, sometimes called a "churchkey", is not a high technology—but it is an elegant piece of engineering. It is simple (no moving parts), reliable, requires the minimum operator force to accomplish the task, requires no special training, and is inexpensive to make and sell. There is clearly much unrealized potential in using low and medium level technology to bridge the gaps between our capabilities as they change with age and the unchanging demands of our home and community environments. This can allow us to cost effectively select and use devices which we need and thus better recognize that aging affects each individual somewhat differently.

Looking to the future, the current pace of development in microprocessing and robotic technologies, such as the seminal work discussed by K.G. Engelhardt, does appear to offer a critically needed range of more appropriately complex solutions to problems faced by those with multiple or more severe problems. However, their approach illustrates how to extend our technology in viable ways while recognizing its appropriate limits. For example, there are manipulative tasks in daily living, such as we found in our analysis of meal preparation, which do involve coordinated

motion by two hands handling a range of object types. The development of robotic technology to assist an older user having severely reduced manipulative capability (i.e. reduced hand flexion and strength) would, for these tasks, require a voice commanded device with two arms and grip devices capable of coordinated movement in three dimensions and with visual and touch sensors capable of discriminating object size, shape and texture to control target object approach and grip jaw force application. Even the most optimistic technologists would have to admit that, at least for the present, there is only one device sophisticated enough in design to have these biomechanical and information processing capabilities—the human.

APPENDIX 1

The Miami Jewish Home and Hospital at Douglas Gardens—an overview of programs:

Serves 20,000 people annually through its institutional and community service programs, research, training, and consultation activities.

Operates a 376 bed nursing home and hospital (expanding to 506 beds in 1985). The facility has been rated superior by the state of Florida and the JCAH since the inception of their rating system.

Offers over $3,500,000 in free care on a total operating budget of $15,000,000 per annum, through active and successful efforts to promote voluntary contributions from community groups and individuals to subsidize the care of the medically needy and indigent. In 1983 over 63 percent of its nursing home residents and 70 percent of its community service clients were medically needy or impoverished by state standards.

Maintains community services for thousands of residents of Dade and Broward counties from all religious, ethnic, and social groups through its three day care programs, its community mental health center and outpatient mental health program, outpatient medical program, adult congregate living facility, and channeling program.

Through the Stein Gerontological Institute: Studies ways to improve the care and treatment of the elderly. Through three National Institute on Aging sponsored grant programs and many other individually sponsored research projects; established the first state accredited nurse aide training school, instituted the first program to give nursing home and ACLF residents opportunity to learn painting and drawing with professional artists, runs job training programs for disadvantaged inner city youth. Helps other long term care facilities and providers plan and operate their programs, through its management consultation program. Trains and offers residencies, internships, and continuing education programs to 1,500 health professionals annually.

And, through its community board of 100 members, thousands of auxiliary members, and staff of 600 is committed to constantly improving and expanding these programs in service to its community and to the state of Florida.

Mr. ROYBAL. Thank you, Dr. Faletti. The Chair recognizes Mr. Arthur Shostak.

STATEMENT OF ARTHUR SHOSTAK

Mr. SHOSTAK. Mr. Chairman and members of the committee, my name is Arthur Shostak. I am a sociologist on the faculty of Drexel University in Philadelphia, and for the past 23 years I have had the privilege of serving as a futurologist as well for a variety of major American corporations, for the AFL–CIO Steelworkers' Union, the George Meaney Center for Labor Studies, and similar groups. Most recently, I have been working as a futurist for groups like the Western Gerontological Society; the National Council on Aging; the Council of Better Business Bureaus (which ran a conference some months ago to help link business and the older consumer more closely.)

I have been asked by your staff to address certain moral and ethical questions raised by new technology in an aging population. I would like to divide my remarks in four areas: Medical, recreation, employment, and computer applications.

I begin with medical, Mr. Chairman, because the high tech prospects here are truly glittering, and what we expect in the next 5 to 10 years may go far beyond anything that we have seen in the last 50.

For example, within the next year or two, it's quite likely that many of the students sitting behind me may be carrying Smart Cards. In use today in France, they are being tested elsewhere in Western Europe. They entail having one's total medical, financial, and personal record embossed on a credit care-sized object. Current Smart Cards contain 49,000 words about the individual carrying them, in comparison with about 49 words inscribed on the back of your American Express, Visa, or MasterCard.

Each Smart Card has an embedded microprocessor so that its data can be updated as a man or womans medical history changes. Each enables its owner to get beyond any loss of consciousness, or confusion and bewilderment that sometimes accompanies a medical emergency for a senior citizen.

We are likely to have major breakthroughs with bio-inserts, or the surgical placement of drug containers into the body of human beings—the drugs being released when body chemistry demands. This innovation goes far beyond nitoglycerine patches that currently relieve the pains of angina sufferers, for the bio-insert will be custom tailored to a wearer's individual needs, rather than in general terms, as with the nitroglycerine patch.

We may have much feedback from bio-sensors as those microscopic gadgets wed electronics and telematics. Embedded in the body, bio-sensors can measure eight vital signs of the human being, and send messages out of the body on the doctor's mainframe computer. This offers the doctor a literal medical exam any time of they day, without physically accessing the patient who can be somewhere else in the community.

We may also have something now called a hospital-on-a-wrist, meaning a gadget the size of a wristwatch that has a drug reservior capable of releasing drugs into the body, as called for by the body.

We are likely to have dramatic new improvements in bionic organs (the electric ear, for example, is 75 percent effective already, and could be much more effective in a year or two).

And, of course, as the committee has undoubtedly heard, medical advances likely to come from gene splicing, interferon, new vaccines, and new ways of testing the body are mind-boggling in the extreme.

Now, the moral and ethical questions at the heart of all of this glitter asks how the costs, which are likely to be quite considerable in the early phases, are to be met. When the telephone was introduced in the late 1800's it was regarded as a luxury item for the elite and the rich, so expensive was its cost of installation! Yet it is now in 90 percent or more of all households. Initially expensive items like television have a similar break-even history. But the initial costs of medical gains are likely to be very great. There could be considerable disparity between the clamor for, and the ability to pay, and that disparity may haunt all of us for years to come.

In the area of recreation and leisure, we are about to watch 172 million analog television sets become obsolete. When that occurs

we will turn a corner in the development of the American electronic household. Major companies in this country—RCA, GE, and their major competitors abroad—will soon offer a new digital television. And, with its arrival, we move forward to what is called viewers liberation.

Digital basically puts a microcomputer into the television set and changes the nature of the signal—with digital, the viewer can control the image. The viewer becomes a TV director, for the set is capable now of receiving 7 signals or even 13 signals, and viewer can divide what to zoom in. Wherever different cameras are pointing, the individual in his or her living room can determine the picture on the set. As well, the new sets will have a third channel. That means that a listener could choose whether to hear a sound track that's quite sophisticated or a sound track for neophytes, for people brand new to the subject. We would no longer rely on only one sound track, but would now have much more variety.

Digital television raises an unusual moral challenge—namely, it invites a new type of paralyzing viewership, a new type of enervating passivity from men and women who really ought to be getting up and around instead of sitting still and viewing TV even longer.

So, there is an irony here in seeing digital TV as an advance—there is a mixed blessing here. The digital TV set will have a 35-millimeter quality picture, one of remarkable clarity. It will have incredible sound that will be mesmerizing. It will be compelling, and, like the ancient Sirens on the rock in the Ulysses tale, it may lure more and more retirees into more and more passivity than is good for them, good for us, or good for the Nation as a whole.

Digital TV, in turn, may lead to the ECB—or electronic control box—and the ECB is the biggest new development hovering over the scene. Digital TV is basically a technique of bringing microcomputers into the average household through the back door. Digital means that although today in this country only 12 percent of households have microcomputers, when the digital TV set start soon to sell in large numbers, those households that buy will unknowingly secure a built-in micro—and thereby gain their own ECB.

The new electronic control box can link the digital TV set to electrical component in a household, and, from your living-room recliner chair, using a small remote control pushbutton box that comes with your TV set, you will have a Buck Rogers-like capability of starting the roast in the kitchen 20 feet away, checking who is at the front door, listening to your phone messages, doing your banking, and accomplishing all of this without once rising from your recliner chair. The ECB gives us what renowned futurist Alvin Toffler a few years ago called, "the electronic cottage." The ECB has been the missing link.

A command center, the ECB raises an ethical and moral question with its capacity to further divide the haves and have-nots in this country. The ECB will occupy the high price end of the TV electronic line. It will not be cheap as a concept, or as a collection of advanced high tech equipment, and it will be affordable only in affluent homes. Other households, including many led by retirees, will look on enviously and in a troubled way at those who can afford the ECB advantages.

Employment, the third area I want to comment on, troubles me enormously. I want to suggest that on the basis of the work I do with labor unions, with businesses, and from the research my graduate students do in robotics, artificial intelligence, cybernetics, smart automation and telematics, I fear that the impact of employment trends on older Americans 50 to 75 years of age will, by and large, be very negative in the years immediately ahead.

I estimate that 25 percent of those workers between 50 and 75 will profit from what I envision happening, but three out of four will be grievously hurt.

One out of four will remain valued for their Calvinist work attitudes, their maturity, and their built-in craft. Many will be thought necessary to meet a labor shortage of entry-level young people not born 20 years ago and not available over the next 10 years. The other three out of four older workers, however, will be bewildered by the advent of smart automation, by the advent of cybernetics, and by the mind-boggling role that artificial intelligence will play in the paperless electronic office and in the workerless factory. So, three out of four older workers will soon rue their inadequate training and inadequate preparation.

The moral, and ethical question raised by my work role prognosis is, "What does a business firm owe to men and women who are precomputer in their personal history, and who find an extended need to reorient their work role? They cannot be expected to turn the corner dramatically and overnight as can some younger people—especially those coming out of community colleges and out of 4-year colleges with ample computer preparation.

Finally, there is this matter of computer applications. Microprocessors are, of course, ubiquitous, and we haven't seen anything yet. I compare what is available now—robots and the rest—to Henry Ford's Model T versus the car called "Kit" which you can see on TV Sunday nights on a show called "Knightrider." The level we are at in advanced electronics today is understandably primitive. Our robots, for example, have a lot of trouble with precise locomotion, with figuring out where they are. They are not likely to have that sort of trouble 3 years from now.

The overarching moral and ethical question here is one of image and contribution, a subject I don't think adequately aired yet at these hearings.

What I would recommend is that some older Americans' organization (perhaps your committee could help) recommend to the U.S. Post Office a competition be held to identify those over 60 who made high tech breakthroughs as oldsters. A series of commemorative stamps could be prepared to honor these gray-haired Americans, linking their pictures with their high tech breakthroughs, and thereby helping Americans of all ages learn that advanced age is no barrier to inventiveness and creature contribution.

I would recommend, second, that companies that have gone the extra distance, the extra mile—Travelers' Insurance comes quickly to mind—and have given additional training necessary to help men and women over 50 learn what the new workplace is about and remain productive in it—that those companies be honored, again by your committee or some related organization, with an annual ceremony of great renown.

I would recommend, third, that if House Joint Resolution 453 passes--and the first week in October is designated "National High Techology Week," I think it desirable to hold special ceremonies when the media is focused that week on high tech. We should hold well-publicized ceremonies to reward men and women over 50 who are doing more than their share to realize the potential inherent in high tech.

Finally, where exploration is concerned, we can innovate to increase access of older Americans to high tech gadgetry. For example, the Internal Revenue Service permits me to take off the costs of my home computer system because I maintain an office at home. It's a legitimate business expense. But my parents, who are in their seventies and live in retirement in Florida, would appreciate the same, or a comparable kind of tax inducement or tax reward. They run no business any longer, however, and intend to run no business from their retirement home.

If we are serious about bridging the gap between the exploration of micros at home and their use by older Americans we must stop penalizing retirees with this Internal Revenue Service stricture on the home office. I urge that IRS be asked to reconsider the reasonableness of the home office regulations when applied to men and women over 60 in retirement.

Second, certain State governments are giving concessions that lead various computer manufactures to donate computers to schools. As commendable as this appears to all of us, I think it would be even more helful if instead of computers going only to schools as a tax writeoff, computers were also to go to retirement village centers, to nursing homes, and to organizations of senior citizens for use as recreational and educational aids.

In this same vein of enlarging the horizons of older Americans, I would recommend that the Department of Agriculture do more with hydroponics and senior citizens. We know that food costs remain a critical part of the total budget of gray-haired retirees. We also know that microcomputers an hydroponics (the raising of vegetables without soil in a corner of your living room) are coming together dramatically, so that in the decade of the eighties hydroponics for the average household should arrive as an appealing option. It is vital that the elderly help us get into this as early as possible, by pioneering here outer Department of Agriculture sponsorship.

I would finally recommend that some senior center in America be urged by your committee to become the first to operationalize a computerized residential information system. It costs only $10,000 to survey the community to identify households where there are enfeebled, aged men and women whose rescue at time of a fire emergency would become vital. By pinpointing the exact location of these men and women, and by putting this data into a computer bank, a dispatcher for the police or fire fighters is able to tell the fire company exactly where in a household an 88-year-old woman confined to a bed must be quickly rescued. It's a simple and yet highly promising use of data gathered by the senior center.

What I have tried to emphasize is the idea that we can and must change the negative image older men and women have of themselves as befuddled, bewildered, and mystified by these new-fangled

machines. We can and must change that image so children will begin to think of gray-haired Americans as their partners in making the future rather than as only the rocking-chair recipients of certain goodies offered in the future. If we can do that, there will be a valuable new role available for older Americans, a unique role as test pilots of 21st century high tech home-oriented possibilities.

My argument is that retirees have time, they have the energy, and they certainly have the smarts to look at a lot of this new equipment and help us assess its strengths and drawbacks . . . before the latter overwhelm the former. As "test pilots" certain volunteers among America's growing millions of retirees could serve as an early alert, an early applause, and an early revision-advising cadre—much to the benefit of high tech producers and consumers alike.

In short, high tech can help America accomplish wondrous things. Elderly Americans, in turn, can do wondrous things for high tech! The central moral and ethical question is: How do we get older Americans to think more of themselves in this respect, and thereby help release the productivity inherent in their retirement and use that productivity to enhance high tech rewards for all of us.

[The prepared statement of Mr. Shostak follows:]

PREPARED STATEMENT OF PROF. ARTHUR B. SHOSTAK, DREXEL UNIVERSITY, DEPARTMENT OF PSYCHOLOGY AND SOCIOLOGY, PHILADELPHIA, PA

When the public policy implications of introducing technology for older Americans are explored attention must be paid to medical advances, leisure breakthroughs, employment prospects, and, more specifically, computer applications in the lives of senior citizens. Each of these is briefly discussed below, the better to set the scene for a review of moral and ethical considerations surrounding life nowadays for America's aging population.

I. *Health Care.*—Public opinion polls regularly attest to remarkably high levels of confidence in pending medical breakthroughs, and, Americans over 65 out do all others in their expectations of these near-future health care gains.

To be sure, the admiration of oldsters for modern medical technology seems well-placed. Thanks to feature print and TV stories geared to older Americans many know that laser surgery has revolutionized cataract operations. CAT scanners have dramatically altered X-ray technology. Mega-vitamin and vitamin C or E therapies have re-directed ambulatory treatments. And, nitrocyclerine patches and similar low tech aides have brought welcomed relief to angina (and similar) sufferers.

Still more excitement is likely to accompany advances between now and 1990 in the use of—

Smart Cards, or credit-card like objects imbedded with a programmable microprocessor capable of storing a user's complete medical file in an up-to-date version;

Bioinserts, such as a 3"-diameter wafer known as PIMS, a $10,000 container that can dispose drugs into the body for 10 years before requiring surgical replacement;

Biosensors, or microchip transmitters that can measure up to eight variables at one time and transmit data out of the body for analysis by a distant computer of a physician;

"Hospital-on-a-Wrist," or a combination of a microanalyzer, and drug reservoirs with electronic probes; the wristwatch-sized gadget will assess changes in the body of the wearer, administer appropriate drugs through the skin, and communicate the entire matter directly with the computer of the wearer's physician; and—

Bionic Organs, including an electric ear, bionic lungs, artificial liver (a hybrid organ made of living cells locked in plastic), artificial bones, bionic limbs, and so on.

When the dazzling possibilities of gene tech, or DNA gene engineering, are added to the list (possibilities that include new drugs like interferon, human endorphins (painkillers), unique vaccines, and powerful hormone treatments), the glowing optimism here of older Americans makes more and more sense.

Naturally, progress will come slower than media hype leads oldsters to expect. And there will be disappointment, false leads, mistakes, and even unavoidable tragedy along the way. Toughest of all challenges, however, is one already painfully evident in medical matters—or the bewildering puzzle of how to meet the attendant costs? All of the high tech medical aids are expensive, and even the economics of scale possible as breakthroughs move from the "R&D" to the commercialization phase will leave many bearing large price tags.

Ironically, then, the very eagerly-awaited "gee whiz" medical aids likely to provide physical health gains for senior citizens may also cost them considerable mental health stress. Large numbers of retirees are going to learn more and more about life-enriching medical breakthroughs outside of their spending range . . . and the ensuing frustration, bewilderment, and rage may overtake and outdistance initial praise for high tech "Godsents." Unless and until the federal government helps assure equitable and compassionate access to expensive new gadgets, an otherwise glittering health scenario for older America will remain grimly threatened by Have-Not outrage of unwelcomed character and proportion.

II. *Leisure Empowerment.*—Perhaps the major high tech impact—next to that likely in health care—will occur in recreation and entertainment.

For example, beginning in late 1984 the TV industry will offer a brand-new digital set, one that will get progressively better through the 1980's, until by 1990 it will offer users—

(1) the ability to split the screen into several different pictures simultaneously;

(2) the ability to control close-ups and zoom shots; essentially the ability to be one's own TV director;

(3) the ability to freeze a TV image and print it out; and—

(4) the ability to access on-screen information services, such as videotext and shop-from-home TV/computer programs.

As if these components of "Viewer's Lib" were not enough, the steadily-improving digital TV sets are highly likely to evolve into the long-awaited ECB, or Electronic Control Box, for any users included in this high tech way.

As a ECB a household's digital TV set will be the center of what futurist Alvin Toffler calls "the Electronic Cottage." That is, an ECB/digitalized TV system will control virtually all electronic household devices (burglar and fire alarm system; refrigerator and freezer; telephone answering machine; lights; sound system; VCR; washer/dryer; etc.). Built-in telephone circuits could allow homeowners to call in instructions miles from home that would activate desired (electronic) functions, even as a retiree staying at home could use his TV/ECB remote control box to "order" household electronic gadgets to do his bidding . . . while he remained anchored in a recliner watching three TV football shows at one time.

Should the TV/ECB take hold as its proponents envision, the average American household will catapault forward toward a high tech empowerment that should make it the unrivalled envy of the world! Life will be easier-than-ever for retirees, and especially for infirmed oldsters intent on caring for themselves outside of nursing homes.

Looming above all other rewards is the possibility that TV/ECB will promote new friendship linkages among retirees otherwise unconnected with one another. Specifically, the TV/ECB system, when upgraded by the (easy) addition of a (digitalized) two-way picture phone, could enable retirees to—

(1) register with an electronic "bulletin board" service;

(2) indicate scores of subjects they would enjoy talking about with retirees (or otherwise);

(3) phone in on whim or by design to designate a time period for a focused discussion; and

(4) enjoy the ensuing dialogue.

In this way retirees could use a vast electronic web (or network) to enlarge the pool of potential acquaintences and friends. Infirmed retirees could reach beyond their sickroom walls, even as able-bodied retirees could surmount geographic distance, inclement weather, or other barriers to making contact with previous strangers . . . and turning this (electronic) contact into a human bond of personal significance.

Drawbacks here are basically three: Reliance on a TV/ECB system could leave a household utterly paralyzed should electric power fail for any considerable time period. Such reliance might also result in excessive utility bills as ever-more demand for electrical energy outstrips current delivery capacity. And, most vexing of all, reliance could stir admiration for a sedentary, effortless style of lazy, button-pushing ways. TV/ECB success could lure households beyond the 7-hour average TV viewing level of 1984, and encourage a passive and unstirring mode of (living room)

existence at sharp odds with the prescriptions of "more exercise!" heard regularly from concerned physicians.

Given the clout of the sponsors (global corporations like RCA, Zenith, GE, and Matsushita, among others) the Electronic Control Box scenario appears a very good bet for 1990–1995 ascendency. Between now and then the digital TV set will help acquaint Americans with unfolding ECB possibilities, and whet appetites to move to the high end, or ECB end of the fast-changing TV line.

This much seems clear: Many retirees will welcome the excitement and user-friendly features of "viewer's lib" TV, or TV that puts you in charge of what you see and hear! Similarly, many will hail the arrival of ECB features, recognizing in them another useful high tech lift to the completion of commonplace household tasks.

Few retirees will worry aloud about possible drawbacks, so incessant and hypnotic will be the sales promotion hype. All the more reason, therefore, to plan now for battery backup systems; for public policy efforts to hold down the cost of electricity; and, for TV public affairs commercials urging elderly viewers to fight against the laziness made possible by TV/ECB . . . and opt instead to exercise all the more!

III. *Employment.*—The picture here is mixed, and uncertain in its near-future impact . . . though far more discomforting than encouraging.

Employers are likely to want to hold onto robust older workers for four reasons:

(1) Young entry-level workers, ages 18–24, will be in short supply until 1990, as their age cohort is disproportionately small relative to the preceeding baby boom generation: In consequence of this, shortages of labor may put certain employers under pressure to retain productive workers over 65.

(2) Workplace demands for physical prowess decrease all the time, thereby reducing any disadvantage an older employee might have here relative to muscular younger co-workers.

(3) Employers increasingly value the well-honed craft, experience, and maturity of seasoned, long-tenure employees: Especially as plant and office automation stirs considerable turmoil in change-wracked workplaces, certain employers will rely on gray-haired employees to calm unease, quell harmful rumors, and maintain desirable levels of productivity.

Finally, certain state-of-the-art employers may want to retain key older workers to study their work ways, and try to capture these practices in sophisticated computer programs known as "expert systems." Pioneered in medical diagnoses, oil exploration, and now in GE's locomotive repair work, this use of certain artificial intelligence methodologies could "close" the life-long accumulated insights of many of the nation's outstanding older employees. This, in turn, should help younger replacements learn the old man's ways from a young man's gimmick (computer-driven "expert system" guidance software).

On the other hand, however, employers are likely to encourage the early retirement of many workers four special reasons:

(1) Factory and office automation will reduce the need to keep the payroll at its present level, and, employers eager to free up a few slots for upward mobility (via promotions), and retain a few entry level openings for outstanding job seekers, may want to nudge out older workers.

(2) Employers may not want to invest time, money, and talent to help older workers get past their computer phobia, and to help them get up to speed on radically new "high-tech" equipment.

(3) Keenly aware that older employees are commonly at the top of their compensation level (wages plus fringes), certain employers may think it desirable to reduce labor costs by replacing these workers with less expensive entry level, or even part-time, employees.

Finally, certain state-of-the-art employers are likely to want to "unload" older employees in the belief that they adapt poorly to the single biggest development now unfolding at work—the shift away from doing things to monitoring data. In the factory and office alike the trend is away from handling raw material to processing the meaning of data: people who were drill operators or file clerks increasingly monitor a panel of dials on an automatic drill machine, or, monitor a data-retrievable system for a paperless electronic file system. Employers expect sharp mental acuity, keen retentive powers, fine analytic abilities, and even occasional flashes of ingenuity from this new stripe of "affiliate" . . . a job performance profile many companies unfairly use against their own gray-haired employees.

On balance, the impact of new technology at work on our aging population appears favorable to an elite minority, say, about 25 percent of those over 60 still at work, and, disadvantageous for the vast majority of the others.

The elite minority are likely to be distinguished figures in the professions, the arts, and management or executive ranks. Their physical and mental well-being will receive a substantial boost from medical and psychopharmaceutical advances, even as their (dual-income) financial needs makes staying on a payroll after 60 (even if only as a consultant) financially helpful and ego-flattering. Above all, these oldsters are likely to remain attached to work because employers believe them hard to replace: They may have a faithful following of clients or customers. Many have adapted to "high tech" possibilities. And, most make little distinction between work and play (retirement holds little alure).

Contrariwise, the near-future impact of new technology at work on about 75 percent of those over 60 might prove very unwelcomed by them.

Many who are the victims of a plant or office closing will find it almost impossible to regain work if they are over 50, while other oldsters still on a payroll may reluctantly grant concession after concession to help keep a business (and payroll) in operation. Above all, ceaseless turmoil in the workplace, as the nation rushes to bring robotics and artificial intelligence to bear on blue and white-collar work, is likely to have employers favor malleable, eager, and computer/literate younger employees over gray-haired, pre-computer stalwarts. Older workers, in sum, confront a combination of stressors likely to drive many from work shortly after their 60th birthday, despite their personal wishes in the matter.

To be sure, there are some, like futurist Alvin Toffler, who forecast a dramatic shift in white-collar work away from the office and into the electronic study of a "high tech" household. Should this occur the older American may be advantaged as seldom before in the competition for scarce jobs: Freed of the burden of work commuting and tight work hour scheduling, grey-haired employees might win a substantial proportion of the new jobs designed for homeplace location. Scoffers, however, like futurist John Naisbett, insist the home "office" will find few takers among corporate decision-makers who prefer conventional office concentrations of subordinates, and distrust any sort of new-fangled electronic dispersion of "the troops."

On balance, employers presently show very little interest in the work-from-home option at this time. However, after the cost of a picture phone has been significantly lowered, and after the tipping point has been reached for computer-using households (that is, when the ratio is one in four, in about 1990 sooner), it is possible that much routine white-collar work may be transferred to home locales. But, few forecasters expect any such development until the mid-1990's. And, until then, the nation's older workers are more likely to rue than to hail new workplace technology.

IV. *Computer Applications.*—By 1990, computer capabilities may have achieved hardware that users can verbally order about without the impediment of today's keyboard. As well, complimentary gains in software should result in programs capable of interacting (via a voice synthesizer) with a human (or robot) user to assure compliance with the user's wishes.

Between now and then, however, older Americans are likely to remain wary of, and even overwhelmed by the bustling new age of ubiquitious computer applicationc (automatic teller machines; point-of-sale electronic cash registers; computerized telephone direct-sale solicitations; etc.). Many oldsters shy from involvement with the new-fangled gadgets, insisting they are too old to learn new tricks, too frightened of "messing up" and breaking the damned thing, or too hesitant about feeling a total beginner at this advanced point in their lives. Not surprisingly, therefore, a 1984 Harris Poll finds six times as many young adults (16–24) as olders (65 and older) claiming computer familiarity.

While understandably, this situation remains regrettable and unnecessary. Nothing in the nature of the demands set by computer systems on users precludes mastery by diligent and motivated senior citizens. An all-too-rare article in a May '84 issue of Info World put a welcomed spotlight on computer devotees over 60, and many retirees quoted in the story spoke with excitement and pleasure about the contribution computers were making to their lives.

Happily, the equipment and its software get increasingly user-friendly all the time. And, more and more intriguing applications evolve—including banking from home; managing your estate from home; shopping via videotext from home; playing (electronic) checkers, chess, or card games with distant others from home; looking things up in a distant library—from home; and, having your doctor give you a go-over, via a home computer hookup. Applications like these, in combination with ease-of-use gains, may help bridge the gap between today's under-utilization by oldsters and the post-1990 normalcy of computer applications in the lives of us all.

V. *Moral and Ethical Considerations.*—As suggested in the discussion above the advent of high tech in the lives of senior citizens raises distinct moral and ethical questions; such as—

How is our society to pay for the high tech medical advances many oldsters will want, but be unable to afford;

How are "gee whiz" developments in passive TV spectatorship to come without undermining the call by physicians for more and more physical exercise by older viewers;

How can society reward employers who choose to make an extra effort to bring older employees up-to-speed with new workplace technologies; and

How can society help oldsters get past their hesitancy to explore the computer frontier . . . even if subsequent rewards are likely to emerge fully only after their demise?

Coursing through all of these puzzles is the fundamental question of the role older Americans can and ought to play in the dynamics of our new post-industrial society.

"High Tech" Imagery.—A pernicious myth that the federal government could help refute now links high tech only with youthful "high rollers," and implies, when it does not declare, that older Americans are simply "out of it" where high tech is concerned.

To be sure, many of the most successful figures in high tech, like Apple Corporation founders Stephen Jobs and Steve Wozniac, have been remarkably young people. And, the central role played in the post-industrial scenario by the computer favors those Americans most adept at gaining computer skills, or, the malleable, fearless, and presumably young neophyte.

Nevertheless, a careful study of the ages of people granted promising "high tech" patents over the past 25 years would probably document a disproportionately heavy representation of inventors over 55. And, as million of viewers of TV's "60 Minutes" show may recall, the Navy's oldest woman on active duty (70) is herself a distinguished pioneer 40-years ago in computer applications.

Publication in the summer of 1984 of an overdue paperback, "computers for Kids over 60" (Kearsley and Furlong), will begin to alter public imagery here in favor of recognizing an oldster/high tech affinity. Much more, however, must be done if older Americans themselves are to link their self-image with a rapidly changing high tech scene . . . if they are to think themselves a proud and contributing component of our high tech future.

To this end the House Select Committee on Aging might consider endorsing one or another of the following image-altering activities:

(1) A series of "high tech/older Americans" commemorative postage stamps might be recommended to the U.S. Post Office; these stamps could honor older Americans who have helped the "high tech" advance, pioneered in educational efforts to acquaint oldsters with high tech, or in some related way, helped model an upbeat approach.

(2) An award-ceremony (dinner, plaques, press conference, etc.) might be held biannually by the Select Committee on Aging to honor corporations that make a special effort to retain older employees; i.e., go out of their way to help such workers get up-to-speed on new technology. (Wherever appropriate, a labor union that cooperated in this campaign should share fully in the honor).

(3) Should the House soon agree with House Joint Resolution 453, a pending proposal to declare a week in October an annual "High Tech" Week, the House Select Committee on Aging could use the occasion and attendent media attention to spotlight new efforts by older Americans to master the use of high tech; e.g., the pioneering use of electronic "bulletin boards" by residents of dynamic retirement communities.

However the task be undertaken, it is vital to refute an overly-simplistic, hasty, and exceedingly costly prejudice which refuses to recognize that many older Americans thrive on high tech much as we wished all Americans did.

"High Tech" Exploration.—Typical of the moral and ethical quandries ahead for older Americans is the question—When a new piece of technology poses a serious moral or ethical challange to older Americans, how and where shall the controversy be joined? By whom should debate be heard? And how shall an opinion be offered, weighed, and conveyed to the largest number?

All of which is to contend that, in addition to altering popular imagery of the senior citizen where high tech is concerned, the House Select Committee on Aging might also want to—

(1) recommend to the NSF, the NIMH, and similar bodies the establishment of research grant programs explicitely concerned with older Americans and high tech;

(2) urge the ARRP, the NCOA, the Western Gerontological Society, and similar groups to establish permanent study groups—with annual published reports—focused on older Americans and high tech;

(3) strive to insure that any forthcoming legislation granting tax concessions to computer companies for equipment grants to schools be broadened to include senior citizen centers, retirement community club houses, and nursing homes; and—

(4) ask the IRS to waive its home workplace regulations and permit purchasers over 65 to deduct a home computer purchase as if it was for a home-based job of theirs.

Techniques of this sort can raise public and policy-maker consciousness about these matters, raise the sights of senior citizens, redirect relevant corporate philanthropy, and help revise detrimental federal regulations.

Mr. ROYBAL. Thank you, Mr. Shostak.

In your testimony, you have already answered some of the questions that I had in mind. But I would like to expand on some of them just for clarification.

You have already looked into the future 10 to 20 years. But there is one question that I must ask in view of the fact that you told the committee that three out of four people are very bewildered. I would be included in those three out of four.

Now, how do you see society adopting or coping with the type of changes that technology brings?

Mr. SHOSTAK. I see society adopting very unevenly. I see dual income couples clamoring for the electronic household. I see a certain stripe of American looking at the digital TV set with eagerness. I see large numbers of others holding back, waiting to see if this will be really useful. We will, however, approach what is called "the tipping point." And when we reach the tipping point, then change will grab you and me however reluctant we be * * * for the home computer the tipping point may be about 25 percent, or one out of four households, and we could be thereby 1987.

Mr. ROYBAL. Dr. Faletti, on that same question, what is your opinion?

Dr. FALETTI. Well, I have a different view of the role for technology, especially as it's currently going. To some extent, technology is a dual-edge sword. I'll take as an example the electronic banker as we go more and more to the electronics funds transfers and what demands that makes on us. I think—and I agree with Mr. Shostak—that it's going to be uneven. Some of us will cope better than others.

But I have to ask the question, "Why do we get into this unevenness?" There can be problems with the remote bank tellers, if you have ever used one in a shopping mall—there's a little keypad and a CRT and you walkup there—depending upon where they are located and the milieu they are in. If you have glare from backlight, it's almost impossible to read the instructions the thing is giving to you. It may be almost impossible to concentrate on what you are doing because they may have it at a very busy corner in the shopping mall and, of course, everybody is cutting that corner tightly and you are constantly aware of people jostling you and that sort of thing. Some of them are located better than others.

Now most of us can probably get through and cope and adapt, but we may—for example, not have the visual acuity to sort out that display under those conditions. My question is, "Is that the only way we can do that sort of task? Is it that much more difficult to insert a voice chip that speaks the instructions as well as shows them on the CRT so that even if I can't see it, I know what's coming up there? Is that so difficult for us to incorporate in a tech-

nology that's going to pervade society?" I don't know, but I think it could be done and from our research is an example of what would go a long way toward solving one of the information processing problems that we all have and that will tend to exacerbate or get worse in aging; that of one modality may not being enough. Vision or audition or something else may not be enough to make sure that we get it all and multiple curing has been practiced in aircraft cockpits and good ergonomic design for years. If we want pilots to make sure that they get a message that something is wrong, we'll have lights going, we'll have auditory cues we're not going to risk using one single cue if that pilot has got to know there is some problem with the aircraft.

I think we have only unevenly begun to think about doing ourselves those kinds of favors in mundane daily activities. Most of the time it doesn't make a difference. But we find in our research, for example, that the normal changes will happen in grip strength, and other capabilities from 40 to 60, or 40 to 80. Nowhere in these data that I have thus far is an explanation of why somebody is independent or not independent in dealing with their own home or environment. There are a lot of people that have experienced these changes that happen to us all and they still function fine. They have been able to adapt and cope. We find many more that drop just a little bit lower. For example, if you can do 30 kilograms at age 40 you are down to maybe 11 kilograms at age 50, 60, or 70, the 11 or 12 can be fine for a lot of torque and grip tasks. When we get down to 8, it's between the 8 and 12 that we see a breakpoint on independence in task performance; we think it occurs largely as a result of environment demand.

As someone who tries to feed data to the technologists I have to be very optimistic about saying, "We can design a can opener that can drop four kilograms of force from the requirement to operate and thus put a whole lot of people back in to being in control of their environment in this respect instead of being out of control. We can modify an arbitrary design standard. So that's the question I ask.

In a lot of the technologies we are going to be making choices about the way we demand users go about using these things. Our research is focused on saying good design is based on bringing in the largest population that we can. We think we have forgotten about ourselves after age 65 and that's why we have started our research. We have looked in the existing human factors data and we don't find ourselves as age 70, we don't find ourselves as age 80. And yet, I think, if designers and technologists had that data, I think they would have very useful tool to say, "All right. We can deal with these users the same way we deal with any other user and begin to make the technology respond."

Mr. ROYBAL. Thank you.

Mr. Shostak, I was very interested in your description of the electronic control box. You also indicated that it is expensive. What direction can the Federal Government take in either assisting in some manner, including the recommendation that you have made with regard to tax inducement, or should the Federal Government not play a role at all? I am going to ask that same question of both Dr. Faletti and Mr. Shostak.

Mr. SHOSTAK. Where the ECB will enable an enfeebled or infirmed individual to have a whole new grant of empowerment, a whole new ability from a fixed spot in the living room to improve their quality of life, in such cases I could see NIH or HHS or some other branch of the Federal Government helping to subsidize the acquisition of ECB equipment. Otherwise, I champion free market mechanisms and expect that if it's as alluring and as empowering as I have suggested, within a year and a half to two years after its introduction the price should be driven down by natural market forces.

Mr. ROYBAL. You have made a recommendation that some senior citizens center somewhere establish a system to identify in the surrounding area the senior citizen community who may have some problem or another, and that the cost was $10,000. Do you know of any center at the present time that is doing that?

Mr. SHOSTAK. Not a center. There is a community in, I believe it's Arizona, that is the first. I read about it, Mr. Chairman, this morning in an excellent source, John Naisbitt's Trend Newsletter—Naisbitt of "Megatrends," where he commends this community and its fire department for initiating it.

What I am recommending is that as word of its availability spreads we pat on the back the first community of senior citizens that takes the initiative here. Rather than have it come from professional firefighters, let it come from a group of retirees who thereby demonstrate their desire to improve their own survivability chances and their affinity for using new computer applications.

Mr. ROYBAL. The question still remains as to cost. $10,000 may not be too much money for some group in the population, but could be a tremendous amount for another group. It seems to me that the group with the greatest need may be that group that doesn't have $10,000 or have available to them the possibility of raising that amount of money, which again, prompts me to ask the question, "Should the Federal Government play a role in this matter?"

Mr. SHOSTAK. It's part of the American genius to steadily create prototypes of less cost (and, possibly less power) than the top of the line item. So I am fairly confident that if this ECB is as magnetic, as useful, and as functional as it can be, that we will have a stripped "bottom of the line model" available very soon. So I would be hesitant about the Government getting in too soon. I would however, ask OTA to take a look at the ECB. It would be important to get an Office of Technology Assessment Report on the electronic household in advance of its coming. OTA has the expertise along with the Congressional Research Service, to give us some valuable preliminary insights into the electronic possibilities.

Mr. ROYBAL. Dr. Faletti, what do you think?

Dr. FALETTI. I think from the standpoint of the role for the Federal Government—and we think about it a lot, because we think about technology as an adjunct to delivery of care and services—that clearly there has been a great deal of involvement by Government at all levels in providing financing and support for services. Perhaps there it's useful. I know, as our medical director constantly reminds me, there is a difference between "needing" and "benefiting from" and that possibly we may need to think through and identify those technologies or the applications of those technologies

that are needed to help maintain someone in their continued state of independence in the same way we would decide they needed outpatient medical services or outpatient health services or mental health services or anything else and that the individual would, in fact, be selecting, choosing and/or given access to technology on that basis—that this can help them in some demonstrable way in which we all agree all members of the society should be helped such as we have done with health care and others things.

There are however, a lot of technologies and, while I am excited about a great number of them and I can see certain possibilities in ergonomics for them as we advance, about which we have to ask, "Do they really make a difference in our ability to live and function independently," "Do they simply provide an enhancement to our quality of life?" The later certainly is desirable and we would like to see it happen and, of course, we will be very happy when the costs come down. But whether or not it is Government's job at any particular level to ensure certain amounts of access to this I really don't know. That's a little bit outside of our view, which is confined more toward technology as an alternative to the kinds of services we are willing to support now.

Mr. ROYBAL. Thank you, gentlemen.

We are fortunate this morning to have in the audience seniors from the "Computer for Kids over 60" and also young students from Georgetown Day School, again, clearly emphasizing that the interest in technology and in computers starts at a very young age and can go on for the rest of one's lifetime.

I would like to at this time have the students come forward so that they can go through the demonstration—and then come back to both of you gentlemen for one final question and that then will conclude this hearing.

Will the young students and the senior students please come forward and let's take a look at another demonstration?

Mr. ROYBAL. Ms. Engelhardt, will you please take over, then, and give the students a demonstration?

[Pause for demonstration]

Mr. ROYBAL. All right, Mr. Shostak and Mr. Faletti?

In your testimony, Mr. Shostak, you made a recommendation. And that is that we support H.J. Res. 453. That piece of legislation was introduced by Congressman Dymally from the State of California, and it calls for a "National High Tech Week" between September 30 through October 6. It is now in the Subcommittee on Census and Population of the Post Office and Civil Service Committee.

We will be urging that that committee mark up that bill, present it to the House. Hopefully, we will have, then, some time to work on it and this committee will do everything we possibly can to see to it that it becomes a reality.

Now, we've had a demonstration of interest from the very young, throughout a lifetime with regard to technology. Both of you gentlemen know that the Congress has been working on this matter of retirement. There's legislation that says there should be no age barrier, that we should retire whenever we desire or, in many instances, when we have to.

Now, in view of the fact that this is a piece of legislation that I believe will be passed by the Congress, what do you see as the

major barriers to keeping the older work force active in the work force, particularly in view of the fact that this technology is being developed to the point where everyone can use it? And would like to ask that same question of both Mr. Faletti and Mr. Shostak.

Mr. SHOSTAK. One of the major barriers to keeping older Americans active in the work force at will, by their own choice, is the prejudicial assumption on the part of managers, supervisors, and certain executives that the physical and mental changes natural in aging are somehow more costly than the company cares to accommodate.

That is a standing problem that gerontologists and practitioners have been working on for several decades. We have good data that suggests that the older American, need apologize for nothing about his or her work performance. The work record here is highly commendable. And these individuals have stored knowledge, maturity, and experience that an employer should value all the more.

Frankly, I am very vexed by what I see happening here. Good intentions and rhetoric on behalf of the ability of men and women to remain at work as long as they meet reasonable work standards may not be enough. At the low end of the employment scale, we are likely, in the next decade, to double and triple the number of illegal immigrants seeking and willing to work for anything, without fringes, and basically "belonging" to the employer.

At the middle level we're going to have a clamor for employment from very vocationally oriented young adults for whom a job is a sine qua non of their existence.

At other levels of work we're going to have more and more automation moving into the office, moving into the warehouse, moving onto the factory floor. And this comes with a worker displacement ratio that staggers the imagination. In the office, for example, three word processers may be able to replace 10 clerk typists. And the biggest impact for the rest of the eighties will come in office, not plant automation.

So, there is a crossover of trends. Labor becomes more replaceable, even as older Americans become more available, more agile, healthier, more alert, and more eager to design their last quarter century, if you will, in a fashion of their own choosing.

I think that the attention of your committee and comparable committees to this cannot be overdone, and the problems of too many Americans desiring a shrinking number of jobs are going to be very, very stressful for this nation.

Mr. ROYBAL. Dr. Faletti?

Dr. FALETTI. Essentially I would have to concur with respect to the work environment, because clearly that's not an area where I would want to comment that much as an expert.

I think in terms of being able to live and function in society I would go back—in both areas, whether we're talking about the ability to function in or out of the workplace—to when we start making decisions about how we are going to configure our society, what kinds of advances we are going to push or to, perhaps, encourage, and in both cases I think the issue, you mentioned performance, is one of thinking age neutral in performance assignment. I know we talk about it a lot in human factors.

Age neutral performance assessments, be they for the job, be they for daily functioning that age is no longer a factor. We can specify what you have to do in that particular task or job, be it in the plant, in the office, in the home, and to a large extent a lot of us, in our research, are beginning to use the kinds of protocols where it doesn't matter what the age of the person is. We're simply looking at skills and capabilities.

As I mentioned before, I don't think that we should fall into the trap of automatically assuming that the changes that go along with aging and that appear to be largely the source of functional changes. Again, we've done a marvelous job at extending life. We're only now beginning to worry about how we extend the function. We can get the shay to go for a long time but we can't get it to hang together all the way until the day it all begins to drop out.

So, we face, in advancing age, the problem of function, and that's going to affect our ability to deal with the workplace or the home.

However, I don't know, based on the data that we have and what others have found, that we have to automatically assume that because we have these age-associated changes in our capability that we necessarily have to buy off and say: Well, that's just the way it is and we are going to have to reconcile ourselves to having a certain progressive disenfranchisement from both work and society at large simply because the devices in the environments are going to demand too much that they're going to out-demand our capabilities to adapt.

I think if we let it go there's a good risk we run that it can work that way, that we can build a software program or build a task for monitoring robots in a factory that's based on selected samples like a lot of the drug trials. You mention the problem with drugs and aging, and we find that a lot of our drug trials are done on 25-to 28-year-old males, weighing about 170 pounds. Well, then we ask, how representative is that information for us at any other point in our development? I think the same could be said for any research or development we do when we test technology from a can opener to a computer.

While I can't speak specifically to the workplace, I think it would be analogous to what we see in the home.

Mr. SHOSTAK. Mr. Chairman, may I add just one more sentence, just to close on a brighter note than the one I struck a moment ago?

Mr. ROYBAL. Please.

Mr. SHOSTAK. The ECB that we looked at, the ECB could mean the importation into the home of a lot of reasonable and attractive white collar work. In short, the ECB could enable men and women in retirement to avoid the journey to work, an arduous commute, and enable them to operate from home when the weather is inclement, or when their health is frail, using the electronic materials that are part of the ECB system.

There are some futurists, like Jack Niles of UCLA, who believe that by 1990 as many as 15 million Americans may be working from home.

Of that 15 million, if committees like your own and organizations that you collaborate with were to take the challenge here to heart,

it's possible that a disproportionate number of those jobs could go to men and women who are in semiretirement and have white collar skills, that would fit this very nicely. And that could be another wonderful option in a finer range of choices in one's senior years.

Mr. ROYBAL. Well, the development then of jobs also for the blue collar worker are definitely a prospect in the future. Is that not correct?

Let me give an example of what I am referring to. I was approached by postal employees in my district who were complaining about the fact that a robot comes down the hall picks up and delivers mail. They said, "We don't like that because we will be out of a job."

A few months later we found that these people were placed in another department, doing perhaps not the same work, but they were not really displaced. Which was what they were afraid of.

Do you envision a situation in the future where these people that may be displaced by the technology that you have been discussing to find employment in a very related field and not necessarily result in the unemployment of those over the age of 50?

Mr. SHOSTAK. Mr. Chairman, we have the highest percent of adults in the labor force of any advanced industrial nation, thanks to the insistence of women that they be gender free to join the work force. We have a higher percent of adults working today than we had during the Second World War as a percent of population.

The future, however, would seem to be forecast by the situation of Great Britain, France, and other European countries that are now experiencing the highest level of involuntary unemployment in this post-World War II history. When I visited England 10 years ago and saw eight people behind the counter of a local bakery, one of them turning and repeating my order to the next of the other seven 'til the order was filled down the end of the counter, I asked, "Why this foolishness?" The explanation from the bakery owner came back, "It beats having them do nothing." My heart sank, Mr. Chairman.

Mr. ROYBAL. Is there a final statement of any kind that you would like to make at this time?

Mr. SHOSTAK. Just one sentence, and that is to recommend again this crazy, off-the-wall idea of older men and women helping society as test pilots. I urge it because there is in their retirement a vast treasury, a reservoir of time and talent, and to see it spent only at golf, to see it spent only in chitchat, to see it spent idling hours away in the malls, in the restaurants, or the shopping malls is, Mr. Chairman, unbecoming. It does us no honor. Senior citizens have a remarkable contribution still to make and we have to help them appreciate that.

Mr. ROYBAL. Dr. Faletti.

Dr. FALETTI. In addition, Mr. Chairman, I think that the key word is alternatives and I don't think we should be in any case saying, "There are good roles, and there are bad roles or there are roles that we value more than others."

The one message that I have gotten over and over in working with older people, is that they tell me, "Look, sonny boy." They say, "You give me my health and my functioning and I know what

to do with the rest of my life just fine." Personally, I think they have hit it right on the head. So when they look to the research, when they look to what is being done, they say, "Can you give me some alternatives and options and I'll take it from there."

Mr. ROYBAL. Well, Mr. Shostak, Dr. Faletti, I thank you for very excellent testimony.

Dr. FALETTI. Thank you, Mr. Chairman.

Mr. SHOSTAK. Thank you.

Mr. ROYBAL. The hearing is now adjourned.

[Whereupon, the hearing was adjourned at 12 p.m., on May 22, 1984.]

APPENDIX

(Additional material received for the hearing record.)

STATEMENT BY LENNIE-MARIE P. TOLLIVER, PH.D., U.S. COMMISSIONER ON AGING

Mr. Chairman and members of the House Select Committee on Aging, I am pleased to have this opportunity to discuss the utilization of science and technology to enhance the lifestyle and wellbeing of older persons. During the past few years the Administration on Aging (AoA) has undertaken a major commitment to a science and technology initiative. We feel that the application of scientific and technological knowledge to the needs of older persons will result in more effective and far reaching solutions that give greater independence to older persons, higher profit to business and industry and all at less cost to society as a whole. I would like to begin by sharing with you some of the background that forms the basis for AoA's interest in this very important area.

A demographic revolution has resulted in an unprecedented number of older persons. Since the turn of the century the population of persons 65 years of age and older has jumped from 4 million individuals to approximately 26 million today. By the end of the century there will be 32 million older Americans, and by the year 2030, more than one in four Americans will be age 60 and over.

The increase in the number of older persons living alone is also quite striking. In 1960, 17 percent or 3.87 million of non-institutionalized older persons lived alone. By 1982 this number had risen to 26 percent or 9.4 million older persons. Older persons who most frequently live alone are women and the oldest of the old population.

Available information indicates that the vast majority of people age 65 and over list their health as good compared to others of their own age but about 3½ million older people need the help of another person in carrying out everyday activities. The incidence of chronic or disabling conditions and the need for help in at least one basic physical activity is substantially higher among people in the older age categories—that segment of the older population growing at the fastest rate. Such conditions include heart disease, cancer, stroke, diabetes, arthritis and emphysema. For those age 65 and over, these conditions account for 81 percent of days of restricted activity. Two chronic conditions cause almost half the limitations: heart disease restricts about 25 percent of the elderly and arthritis another 23 percent. Other limiting conditions include orthopedic impairments (10 percent), visual impairments (10 percent) and hypertension (9 percent).

The number of well elderly with economic means will also continue to expand with the growth in population. About 7 of every 10 heads of households 65 or older own their homes, and 85 percent of this group have no mortgage obligations. Also, according to a 1981 Louis Harris survey, half of employed persons under the age of 65 were not looking forward to complete retirement, and three-fourths preferred to continue working at some kind of part-time paid work. Further, a steadily increasing proportion of women have chosen to enter, reenter or remain in the labor force. Factors such as these indicate increasing availability of disposable income for many older persons.

According to Martech Associates, Inc., products developed in response to the reported needs of older persons could expect a current consumer market segment (with the second highest discretionary income) averaging 9.9 million persons over the age of 55. By the year 2030 an extrapolation of these figures leads to to believe that this market will be approximately 30 million older persons.

These trends and projections indicate a large and diverse consumer population with a wide range of capacities for performing the tasks of everyday living. This group also represents a significant pool of skills, talents and experience that can be made available to the larger society if older persons can maximize their abilities to function independently. The current population of 36 million persons age 60 or over

represent a substantial overlooked consumer market. The 9.4 million who are living alone are a special target population for assistance through products which enhance their capacities to remain self-sufficient and independent.

The implications of the data relative to the market potential in the older population, when combined with the number and variety of unmet needs, provide unlimited opportunities to explore the possibilities for application of science and technology. Although American businesses have been addressing some of the technological needs of older consumers. It has not been done in a concerted and planned manner. Technology has played a major role in increasing the standard of living and improving the quality of life for the population as a whole. However, an AoA review of public and private technology transfer activities indicates that, for the most part, the older population has been overlooked in the formulation of research agendas and in the development and transfer of technology.

Many experts believe that the future of the United States economy will largely depend on how well new technologies are used to create products, jobs and markets. Increased reliance on development of new and better technologies, plus the increasing foreign competition for sales of products that use new technologies, is posing a challenge to America's economic future. These economic trends and the demographic trend toward a population that is rapidly growing older present a unique opportunity. The opportunity comes from the fact that the older population, which is growing at twice the general rate, represents a large emerging consumer market for new products. Capitalizing on this opportunity will favor business and industry, older persons and the economy as a whole.

As Commissioner on Aging, I believe that visible national leadership with a strong commitment to utilizing science and technology to benefit the elderly is needed. I also believe that AoA can play a unique role by undertaking efforts to bring these two seemingly disparate trends together. Collaboration on a plan of action which involves AoA, other Federal agencies, State and Area Agencies on Aging, national and local aging organizations, universities, business, industry and other parts of the private sector is most important. And, of paramount importance is the involvement of older persons in public and in private sector science and technology dialogue and resulting efforts.

In light of the demographics of our older population, their unique needs as a consumer group, and the vast opportunities for a technological response to these needs, AoA has undertaken a three pronged science and technology initiative. The first goal of the initiative is to educate businesses and corporations about the functional problems of older persons and encourage them to develop, apply and market scientific and technical advances designed to improve the quality of life for older adults. AoA's second goal is to increase the knowledge and understanding of the functional problems of older people by practitioners and those preparing for careers in professions associated with the application of science and technology. Thirdly, we hope to influence the knowledge and buying practices of older persons, such that they secure products more suitably designed for their own use.

One phase of our science and technology initiative has involved developmental activities with the U.S. Departments of Commerce and Defense, and the National Aeronautics and Space Administration. We have also initiated contact with some representatives of the 200 member Federal Laboratory Consortium.

These organizations were initially selected for participation in our activities because of the potential for their resources to positively affect the older population and because of their established ties with industry. For example, the Department of Defense spent $80 million in 1980 on efforts to effect technology transfer. Many of their efforts dealt directly with the business sector and the manufacture of new products. Through our efforts to maintain a working relationship with the Department of Defense, Department of Commerce and others in the Federal, State, local and private sectors, AoA hopes to target the development of new products to specifically assist older persons in maintaining their self-sufficiency and increasing their independence.

In one effort to increase private sector interest in the development of new products for the aging population, AoA entered into a cooperative agreement with the Carbide Retiree Service Corps (CRSC). CRSC is a group of retired Union Carbide scientists, engineers and business men who volunteer their time in the initiation of partnerships between the aging network and the private sector to effect technology transfer for the benefit of older persons.

Under our cooperative agreement, CRSC has initially mobilized volunteers in three States. In each of these States, South Carolina, New Jersey and West Virginia, CRSC volunteers work with the Stage Agency on Aging to identify areas where technology has the potential to benefit older persons. After a list of needs has been

compiled and agreed upon, the CRSC volunteer begins a search for a technology to meet the identified need.

As a result of this agreement the CRSC brought together the South Carolina Commission on Aging and the University of Wisconsin-Stout where innovation in bathroom design has been implemented by faculty and students. AoA, the South Carolina Commission on Aging and CRSC have joined together to focus national attention on the application of technology to the design of this bathroom for older persons. It is AoA's intent that further research and prototype design and testing in this area will be stimulated and the concepts adopted by commercial producers of bathroom equipment.

AoA has also funded a needs analysis of the problems experienced by older persons in the course of everyday living. This detailed needs analysis has already been disseminated to the nationwide network of Technology Commercialization Centers established by the Department of Commerce, the Federal Laboratory Consortium and other technology sources. The needs analysis is now being compiled into a more detailed report about technology commercialization and older persons. We hope to disseminate the final report to the business and corporate communities in an effort to stimulate their interest in the development and marketing of products for older persons.

In the interest of fostering more involvement in the field of aging by science and technology professionals, AoA has awarded a number of training grants to professional associations and institutions of higher learning. These courses, utilizing the latest scientific findings and advances in gerontology, will prepare professionals to apply this knowledge in their respective fields. I'd like to share with you some examples of our training grant activities in this field:

A Syracuse University project provides gerontological training to managers in commerce and industry and establishes a Stage Agency advisor to scientists and engineers on aging issues.

The American Institute of Architects is developing a training program to improve the ability of practicing architects to meet the environmental design needs of older persons.

A University of Maryland project offers graduate training in gerontology to students in a variety of curricula including architecture and engineering.

In Baltimore, a grant to Morgan State University provides for inclusion of gerontological training in the business administration curriculum.

The application of science and technology to the employment needs of older people is being demonstrated through a grant to Operation Able in Chicago, Illinois. Computer-based instruction, guidebooks and other methods will be utilized to help older people enter the marketplace and secure satisfying and appropriate employment.

In closing, it is clear to AoA that exploration of the potential use of science and technology to increase the independence and preserve the dignity of older people is imperative. AoA sees a unique opportunity to affect the activities of public and private agencies and organizations and to maximize current science and technology resources to assist older persons in their daily living. We are encouraged by the growing interest in this approach. By working together, I am hopeful that we can eliminate barriers and increase incentives for development and commercialization of new products for older persons.

Technology in the Care of the Aging Veteran

Statement By Paul A.L. Haber, M.D., Regional Coordinator for Aging, Region VI, Department of Medicine and Surgery, U.S. Veterans Administration

This paper proposes to discuss the impact of new high technology in the area of aging. The objective here is to stimulate thought and discussion among practitioners in the medical community about the application of technology in the provision of health care. As a geriatrician, my concern is primarily with the application of technology to solve the problems of aging both in health care and quality of life; but it is apparent that ultimately some of the same thinking will have to be engaged in, irrespective of age.

There are many issues with respect to the pursuit and application of technology in aging and they are not easy to grapple with. In the first instance, there is the question of bioethics. If new technology is to be pursued to sharpen our health care skills, the question inevitably raises itself as to who should benefit. Once that question has been raised, the next question comes as to who should pay for it. At present

many government and private agencies are concerned with the application of technology. The feeling is rampant that before there is general acceptance of the technology (as evidenced by the fact that the Health Care Financing Agency agrees to pay for it), there has to be an evaluation which deals with cost and cost effectiveness and a whole host of other considerations.

The relationship of technology to research must be clearly defined, and the vigor with which research studies are translated into technological advances is a function of the concern that society places upon any particular mode of treatment. Not only are advances which make diagnostic and therapeutic interventions more certain, but there are now concerns about the prolongation of life in patients who have incurable or fatal disease. It is now well known that health care the last year of life is the most expensive. Among Medicare beneficiaries in 1976, dying persons in their last year of life spent 7.2 times and in their next to last year of life 2.3 times as much as those who survived at least two years. As Dr. James Fries points out in his article entitled "Aging, Natural Death and the Compression of Morbidity" in the New England Journal of Medicine in July 1980, we now become aware of the fact that the health care dollar already stretched thin has to be conserved if we are to continue to benefit the largest segment of the population. Dr. Fries advocates the withholding of high technology to the elderly patient. It becomes apparent that the physician is frequently at the center of this controversy. His concern is with the individual patient but in the larger sense all patients. He stands between the tensions generated by the society be they economic, ethical, demographic, or other and the care of the individual patient and unless the physician is informed about technology and its potential implications, he is not well prepared to serve in that role.

A number of conferences under non-medical leadership dealing with technology in aging have been held in recent years. I cite a conference hosted by the Gerontology Society of America and the Western Gerontological Society, at Racine, Wisconsin, another at Albuquerque by the Western Gerontological Society, and a third last summer in Los Angeles, sponsored by NATO and USC's Ethel Percy Andrus Gerontology Center.

At present there exists a current turning away from emphasis on high technology. This may be due to a misguided perception by some people that the cost of medical care is escalating principally because of the introduction of high technology. One would agree that indiscriminate application of high technology can act to escalate costs of care and therefore should be avoided. But to implicate all high technology as expensive and therefore wasteful is an unfair indictment. Of particular concern however, is that the elderly may suffer especially from this prejudice against high technology. The common misconception is that long term care is based on the absence of technology or on old technology and, therefore, it must be cheaper.

There are three arguments against that philosophy. In the first place, high technology as indicated above, is not necessarily cost escalating. If, as in the case of the CAT Scanner, we can shorten hospital stays because of the application of diagnostic high technology techniques, that in itself can be cost saving. Second, it is antiethical to the basic precepts of medicine to withhold effective treatment simply because it is expensive. Third, I believe that the application of the opposition to high technology and the elderly is a not so subtle form of ageism. At this juncture some definitions are in order.

One useful definition is that of Dr. Everett M. Rogers of Stanford University in his text, "The Diffusion of Innovations," "A technology is a design for instrumental action that reduces the uncertainty of the cause and effect relationships involved in achieving a desired outcome." In medicine we are trained to establish cause-effect relationships whenever we can so that this definition of technology is a useful one for us in the health sciences. I would like, starting with that base, to differentiate between high, midlevel, and low level technology as follows:

Low level technology involves the use of homely objects which surround us but which need to be modified in order to achieve a useful function. This is particularly important as will be developed later in the modification of the activities of daily living where the furniture, the transportation systems, the design of our interior dwelling places all come to mind. Low technology is technology in current use which may require modification.

Midlevel technology is meant to mean those devices and systems which involve more than simple mechanical manipulation and employs other than simple mechanical energy sources. Devices such as television, radio, telephone, x-ray for both diagnostic and treatment uses, etc. are all involved in midlevel technology.

High level technology includes those devices and procedures which have not yet reached mass production and which represent the really new innovations in health

care. This would mean such procedures as major organ transplantation and devices as nuclear magnetic resonance and other exotic imaging devices.

Thus having defined technology, it now is useful to consider its taxonomy. For the purposes under discussion I would divide technology into two main forms—health care technology and quality of life technology. Under health care technology there are five subgroups. They are as follows:

a. Diagnostic devices and procedures. An example of this might be under devices such as the CT Scanner, or cineangiography under procedures.

b. Therapeutic devices and procedures. An example of this under devices is the linearaccelerator for cancer treatment and under procedures, open heart surgery.

c. Drugs. I believe this speaks for itself and requires no further illustration.

d. Prosthetics. This includes development of artificial limbs and other more exotic implantable devices such as the artificial heart.

e. Health Services Research. An example of this might be the development of new programs for health care delivery such as home care or a different kind of outpatient activity.

The second large group of technological advances would be those which are concerned with the quality of living. Under the quality of living I would include the following examples:

a. Activities of daily living. Here we are talking about the ability to care for oneself directly in the sense of being able to perform such tasks as eating, sleeping, toileting, grooming, bathing and transferring.

b. Mobility in general, involving the use of transportation systems or devices to enable an individual to get from one part of the city to another or between cities.

c. Communication devices. This involves the use of telephones, radios, televisions, closed line systems and the whole paraphernalia of the information media.

d. Interior design.

e. Urban design including redesign of work place.

For the most part health care technology is being pursued in the medical academic world. The new innovation in the health care industry particularly as it involves diagnostic and therapeutic devices and procedures are being followed with close interaction between the medical academic world and the medical industrial complex. This tends to be one of the most visible parts of our journals and the lay press alike. I would like to discuss briefly the VA's role in attempting to bring about a further evaluation in deployment of such technology.

In the Veterans Administration we have set up a series of Special Medical Programs which for the most part are geared towards incorporating new technology into the VA system. We have Special Medical Programs (SMPs) for intensive care units, for certain medical specialties, for coronary artery disease, for renal dialysis, and so on. The basic thrust of these special medical programs is to permit acquisition and deployment of these high technology modalities in such a fashion that they can be put where they are the greatest use. In order to achieve this deployment of special medical programs, a rigorous programmatic examination is conducted.

At this point the concept of maximal utilization and productivity enters. This also permits the further monitoring of the system by our Central Office which weeds out the inefficient or wasteful utilization. If, for instance, a given VA medical center were not to perform up to a certain standard of productivity, we would consider the possibility of closing that Special Medical Program down in favor of moving that technology to another hospital where it could be put to greater use.

I would like to examine some examples of technology that are good, some that are bad, and some areas where I believe the introduction of higher technologies could well serve the aging population. I think that a few examples of good technology leap rapidly to mind. In the first place, there is the story of the CAT Scanner. This remarkable device has undoubtedly helped in the care of the aging simply in the application of head scans. For example, to quote from a 1978 study, "A Report on the Evaluation of Computerized Tomography (CT) Units within VA Hospitals," there has been a profound effect in almost all instances on the utilization of radiouclide scanning, cerebral angiography, and pneumoencephalography. There has in addition, been a somewhat surprising, and not entirely anticipated impact on the utilization of EEG.

Our experience demonstrates most dramatically that there has been an impressive effect on the utilization of these alternative procedures. Thus, our most recent experiences shows that the average utilization of radionuclide scans within the 11 hospitals is down by a factor of 33%. The drop of ten of the hospitals ranged from 9% to 73%.

Another example is the use of renal dialysis to preserve life. Again, the number of elderly who are being offered this life preserving procedure is increasing, and I

think this is with great benefit to the care of the aged. The same might be true of coronary artery by-pass studies, and I have gleaned the following data from the VA.

Our data and dialysis show that we offer dialysis on a continuing basis to about 4,000 patients regularly. Of this number, approximately 6 percent or 240 patients are 65 or more, and they receive about 16,000 treatments per year. This is remarkable when one considers that at the time of the first offering dialysis, age in excess of 65 was considered a contraindication to starting dialysis. Our data on coronary artery surgery also indicate that in FY 1983 the VA conducted 5,095 coronary bypass operations, of which 10–15 percent were performed on veterans 65 and over.

Some examples of poor application of high technology are interesting too. A few examples come to mind immediately.

Another example of high technology which hasn't worked out is the application of multiphasic screening devices. We in the VA were very much in favor of examining this modality in the 60's. Nowadays one does not hear much about the use of multiphasic screening simply because it has not paid off.

Finally, the use of hyperbaric oxygen to improve cognitive functioning in the aging has also been an example of an instance there high technology did not avail.

One egregious example of the retardation of application of technology is the slowness of adoption of citric acid-bearing fruits for the prevention of scurvy. Fully 150 years elapsed between the time it was first demonstrated that scurvy could be prevented by including limes in the diet in the British Navy and its official adoption by the Navy. Interestingly enough, it took the Americans another 30 years to reach the same conclusion. Again Everett Rogers points out that there is a natural process of adoption, when graphed against time, that tends to take an 'S' shaped curve which approaches infinity asymptotically. Although Rogers does acknowledge that some 'S' shaped curves have a steep curve, others may have a vary slow rate of adoption. Rogers goes on to point out that the social structure of a given profession has a great deal to do with the rate of diffusion. There are those who play the role of opinion leaders and change agents and there are those who are, according to his classification early adopters, the early majority, the late majority, and the laggards. If a given innovation has been quickly adopted by the opinion leaders or innovators, in certain professions it tends to diffuse more rapidly. In medicine this is generally the case. There is, however, a strong disinclination to be among the first to try new innovation on the part of many practitioners, the feeling being that time will show some of the undersirable results are obscured in the early stages of any innovation, and particulary in the field of drugs this is true.

A number of examples such as oraflex and thalidomide are cases where physicians in large numbers held back from administering these drugs only to find that their apprehension became justified.

One of the concerns about the adoption of technology is the diffusion of information in arriving at technology. This is a process which is dependent upon but quite separate from the evaluation phase of technology assessment. The National Institutes of Health have developed a methodology called Consensus Conferences which had considerable vogue over the past several years and which to my mind represents one very effective way of building consensus. Obviously a third mechanism is through continuing medical education and conferences and colloquia which are held by medical academic institutions. A fourth and obvious method is through the normal pursuit of sales information dissemination and the use of 'detail' men by drug firms and medical equipment firms.

The process of assessing technologies in health care has attracted wide attention as might be expected in recent years. Several bodies have taken it upon themselves to become involved in technology assessment. The foremost of these probably is the Office of Technology Assessment, an arm of the Congress which has published valuable materials regarding the basic process of assessment and has given guidelines to many others who are interested in this activity. The American Medical Association has devoted considerable time and effort as has the Joint Commission on Hospitals Accredition and the American Hospital Association. The American College of Physicians has developed a very effective program called the 'Clinical Efficacy Assessment Project' (CEAP) which has over the past several years brought about the assessment of a score or more of new technologies. It tends to concentrate on technologies which would be incorporated in the armamentarium of the average practicing internist. One, a group that had developed technology assessment to a very fine degree was the short-lived Center for National Health Care Technology which expired in late 1981 after having been deprived of operating funds for the previous six to twelve months. Obviously the Food and Drug Administration Devices Division has also developed a systematic methodology for reviewing technology and undoubtedly a number of other groups will be formed in the near future.

I would now like to dwell upon the new innovations that probably will change the course of care for the elderly. I think that in the area of diagnostics more use needs to be made of non-invasive diagnostic technologies. The ability of taking small pinprick blood samples which then can be treated with reagents for analysis will obviously come into more demand in the future. Non-invasive diagnostic techniques for heart problems such as the technitium and thallium scans will get greater use.

One general principle that has to be recognized is that if one can move information one does not have to move people. I am talking now about the possibility of linking sophisticated diagnostic methodologies with computers and analytic devices based at some distance from the patient. We already can provide EKG interpretations through the use of telephone lines to analytic devices on the basis of programs that were developed for interpreting EKGs. I would submit that the same mechanism ought to be applied to EEGs. The use of long distance devices for monitoring the power source in cardiac pacemakers is already widespread and needs to be improved. There are devices on the market now which can conduct pulmonary functions testing, relay the information to a central computer or analyzer, and then have the answer come back within a matter of minutes. We need to make greater use of this entire conception.

One interesting area of technology is the use of biosensors. In a recent issue of the Journal of High Technology (Nov 1983) Dr. H. Garrett DeYoung has an illuminating article about the use of biosensors. One area where this will become very improtant is in the treatment of diabetes. Currently there are a number of experiments which point to the use of diffusion pumps for administering insulin over a period of time to the patients. Admittedly these are still in the exprimental stage but one difficulty is that the diffusion pump must be regulated on the basis of spot information, a number of glucose determinations, before it can be adjusted. The obvious answer is to be able to develop a biosensor which can monitor plasma glucose concentration continously and then feed its information back to the pump to regulate the flow of exogensous insulin. Such biosensors are now under active development and a number of research centers, at the University of Utah, and the University of Pennsylvania, and the University of Pittsburgh Medical School. Such biosensors tend to be of four different electronic configurations. First potentiometric electrodes, second enzyme thermistors, third optoelectronic devices, and finally electrochemical sensitive transistors.

One important area for the future is the determination of whether or not in a given instance we should use transplantation of human or other animal organs or instead look for artificial devices to assume that function. In both kidney and heart function replacements, the argument is going on apace. I submit that the time is ripe for us to develop criteria by which we can determine at given stage whether or not it is useful to pursue the research in determining whether or not an artificial organ or replacement organ is more advantageous. Such considerations as cost, immunologic defense, and harvesting problems must come under discussion by physicians to develop a rational approach. It is common knowledge that the American Red Cross blood donor program on a voluntary basis is the backbone of our being able to supply blood to individuals who need it, but it is clear that in some instances, particularly in the case of rare blood types, harvesting on a voluntary basis may not be the answer. These are issues which physicians will have to take a stand on in order to enlighten the public and I would suggest that we urge our local medical societies and bodies such as the Academy to appoint groups to try to formulate basic opinions which can be of use to the general public.

I would like to close this discussion on technology in the use of the aging with the description of what we are doing at the Palo Alto VA Medical Center. We are beginning to establish a laboratory for research and development into the activities of daily living. The function of this group will be to test low technology devices inherent in the environment which will give us the opportunity of modifying home devices of furniture, beds, chairs, tables, eating utensils, toilets, and so on, to prepare them for independent useby the elderly. This group will ultimately consist of bioengineers, human factors engineers, occupational therapists, supply service personnel, nurses and physicians and the whole array of others who are involved in caring for the elderly patient. Attempts will be made to evaluate these devices both in the home and in the long term care institutions, to determine their applicability to the world outside.

Possibly most exciting of all is the development of robotic aids in the service of the elderly. We have developed robotic aids which are beginning to combine artificial intelligence and can respond to voice command. The interdisposition of robotic aids in long term care settings would at first glance seem to depersonalize further an already impersonal atmosphere. On the other hand, the use of robotics to pre-

pare patients for certain kinds of activities of daily living, particularly bathing, feeding, transferring, and other activities might free up personnel to deal with patients on a much more personal basis where the need is required.

I think the question of technology is one that we will have to answer soon. It is with us whether we like it or not. The question is will we master it or will it master us?

STATEMENT OF JACK L. BOWERSOX, OWNER, PRESIDENT, DESIGN THROUGH RESEARCH ARCHITECTS, P.A. OF MINNEAPOLIS, MN AND PORTLAND, OR

In order to understand design criteria and recommendations for housing and long term care environments for elderly persons, one must first be aware of the functional needs of both the residents and staff members of each type of facility and service. The design solutions to meet these needs will sometimes be in conflict and require a compromise or choice between staff needs versus resident needs within given economic restraints. This author maintains that the resident needs should be given the highest priority while maintaining financial feasibility. The provision of the most suitable environment for the elderly resident is a service in itself and, in many cases, reduces the need for staff assistance.

One must also consider that aging is a process and the functional levels of each individual will generally be decreasing at different rates. The ability of an older person to negotiate the environment will also fluctuate from day to day dependent upon having a "good day" or a "bad day." For the environment to be compatible with changing functional levels "adaptability" must be provided wherever economically feasible. Adaptability should allow for the adjustment of the environment to meet the ability of the older person to maximize independence and to achieve the highest potential of housing satisfaction.

Design criteria and responses to meet the functional needs of the elderly resident can only be established by understanding how the environment is perceived and negotiated by the older person.

HEARING

Older persons experience difficulties in discriminating normal conversation against a background of competing noise, which may generate from the building mechanical systems, traffic (inside and outside of the facility), echos, music, dishes, and other conversations. As hearing loss begins to occur, high frequencies will not be perceived—also affecting the older person's ability to respond to warning signals. Design responses are:

1. Earth birms, trees, and large plant material will assist in diverting and absorbing traffic noise from adjacent streets.
2. Tight window weather seals should be maintained to reduce exterior sound transmission.
3. Partitions with a high sound rating should be used around noise-generating areas such as mechanical rooms, maintenance rooms, central kitchens, shops, laundry rooms, music and activity rooms.
4. Sound absorbing materials should be used on vertical and horizontal surfaces in spaces where normal conversation is to be encouraged. These materials include acoustical ceilings, carpeting, wall coverings, draperies, and wall hangings.
5. Acoustic "decorative" baffles can be hung from the ceiling to reduce echos.
6. Audible warning signals—such as fire alarms and stove top timers—should also be equipped with flashing lights.

VISION

As the eye ages the lens will harden and yellow. The hardening of the lens, which occurs unevenly, will cause bright rays of light or glare to be misdirected within the eye and impair vision. This vision impairment will also occur when an older person is sitting in direct sunlight. The pupil dilation and contraction rate is slowed which impairs vision when the field of vision changes from dark to light areas. Older persons also require approximately three times the amount of light to accomplish the same task without additional eye strain as younger persons.

Design responses are:

1. Location and type of trees should be studied to shade major building glass areas and courtyards. If exterior use areas cannot be shaded by this means, a physical structure (wood trellis) should be designed to accomplish the same result. Without these design responses, exterior areas will not be used.
2. Roof overhangs, awnings or building recesses should be designed to limit direct sunlight penetration through building glass areas.

3. For interior window treatment, pull down shades should be used along with draperies to reduce sunlight penetration from the upper portion of the window. Tinted mylar shades will allow for exterior viewing while reducing window glare, if tinted glass is not feasible.

4. Glossy or shiny surfaces should be totally avoided due to their reflective qualities which cause glare. Surfaces of special concern are floors, walls, tables, countertops and cabinet work. Sealants and waxes which leave a gloss or shine should not be used.

5. Light fixtures are the main source of glare in most housing and long term care environments. Fixtures should be selected which conceal the source of light such as wall-mounted valance lighting. If a ceiling location is required, a fixture should be selected which controls the spread of light and directs the largest percentage of light rays directly below the fixture. Caution should be taken, however, to space the fixtures to create an even level of light at the floor or table height, depending on the use of the space. If pools of brighter floor areas occur from the light fixtures or direct sunlight, many older persons will perceive these as steps and falls can result. Fluorescent fixtures should be carefully selected due to potential flickering and humming to which older persons are more sensitive. Flickering and humming are generally caused by worn out ballasts (rather than the bulb or starter) which should be changed periodically.

6. Exterior lighting should be located to restrict light from shining into windows. Globe-type fixtures created tremendous glare and vision past the fixture is almost impossible. Indirect lighting should also be used outdoors such as up lights in trees and large plant materials. Low walkway lighting should be used which lights the surface evenly but does not allow light rays to be diffused at eye level.

7. Good contrast between the focal object and background is required by older persons in order to discriminate significant features in the environment. Elements of major concern are signs, doors, bulletin boards, reading material, obstacles and handles on fixtures.

8. Although colors are an effective means of communicating with older persons, the yellowing of the lens causes difficulty in distinguishing blues, greens, and pastel colors. Very dark navy, black, brown and grey tones are also difficult to discriminate. Bright colors may be clearly read as contrasts on neutral backgrounds. Reds, oranges, bright blues, strong greens and violets should be used. Bold patterns should be used instead of small contrasting intricate patterns which may cause dizziness.

9. To achieve a higher level of light to perform specific tasks, the additional light should be introduced close to work surface in the form of desk lights or undercounter lighting. Additional lighting at ceiling height will only add to the glare problem.

SENSE OF TOUCH

The sense of touch becomes increasingly important in that this sense, generally speaking, is not reduced as a mere function of age. As other senses diminish the older person will rely more on the sense of touch to pick up stimuli from the environment. The institutional environment, however, has historically been devoid of tactile stimulation as a trade-off for ease of maintenance. The older person has, therefore, been deprived from compensating and using this information source.

Design responses are:

1. Wall surfaces and flooring may effectively be covered with tactile materials to increase their "readability." Changes in these materials may be used to signify an important feature or location within the environment. This concept can also effectively be employed in outside courtyards and patios.

2. The substitution of wood for metal is not only more visually attractive and residential in character but also warmer and more inviting to touch.

3. The use of Braille in the long term care environment has little positive affect in providing more information through the sense of touch. Due to the fact that most older persons have encountered vision problems at an advanced age, Braille has not and probably will not be learned. Raised or recessed letters and numbers should be used.

4. Tactile warning signals should also be introduced through the use of gnarling on door handles to spaces of potential dangers such as mechanical areas and stair wells. Similar tactile signals should also be used on hand railings within close proximity of stairs or ramps.

5. Tactile decorations such as draperies, coarse wall hangings, plants and non-absorbent upholstery should be provided.

ORIENTATION TO TIME AND PLACE

As short and long term memory losses begin to occur (in many cases accelerated due to relocation trauma), orientation to time and place becomes increasingly more important. Most older persons have culturally been familiar with rectilinear spaces and are confused by the so-called "contemporary designs" which introduce numerous angles in circulation patterns and spatial areas. Numerous and repetitious environmental ques (signage) will reinforce one's cognitive mapping process. Elements should be designed into the environment which can be changed for various seasons. Clocks and calendars should be predominantly located. Special daily events should be posted and highlighted.

Design responses are:

1. Environmental ques should be provided through the use of signs or, wherever possible, elements in the interior design—which are culturally familiar—should replace signs such as a barber pole outside of the barber shop. Different styles and colors of furniture combined with a particular painting could signify a certain floor rather than large numbers (super graphics) which are not culturally familiar to older people and reinforce the institutional feeling. The dining room should be given the decor of a restaurant and the gift shop should be designed to appear as a store which provides the opportunity to make choices and deal with money. Hallways or certain areas of a building may be given names such as streets or neighborhoods.
2. On the exterior, plant materials should be selected which will change color at different times of the year. Flowering plants—both for indoor and outdoor use—should be maintained which blossom at various times of the growing seasons and give off different fragrances.
3. Clocks with non-reflectant faces with large arabic numbers should be located at eye level.
4. Large floor-to-ceiling bulletin boards or display panels—which can be changed for special events or seasons—should be provided throughout the facility.
5. Graphic signs using simple letter styles with little or no seraphs should be located no higher than 4'-0" from the floor. The letters should be recessed or raised ⅛" and a minimum of 1" high for readability through touch.

PERSONALIZATION

Each individual, old or young, has the need to impose his or her personality upon the environment in which he or she lives. This may take the form of remodeling and/or redecorating a house or apartment upon occupancy. Once this has been accomplished the new environment usually takes on the concept of "home." Older people—due to the loss of family and friends—also place more personal attachment on furniture and household belongings. The environment should be designed to allow the older person the opportunity to use certain pieces of familiar furniture in various arrangements, and to display personal affects and pictures.

Design responses are:

1. A drapery track should be provided to allow for the hanging of one's own draperies.
2. Shelves should be provided to allow for the display of family photographs and memorabilia.
3. Windowsills and display shelves should be large enough for the placement of pictures, plants and personal effects.
4. Apartment and nursing home room layouts should accommodate a variety of furniture layouts and furniture sizes.
5. Personal decoration should be allowed in the hallways at entry doors to the living unit. This will also help in orientation and remove the institutional feelings.
6. Residents should be encouraged to hang their own pictures in other places of the facility and place their own furniture in lounges.
7. Large areas of tackable surfaces should be provided. This can be accomplished through the use of certain wall coverings.
8. The use of one's own bedspread should be encouraged in long term care settings.

MOBILITY AND AGILITY

The aging process generally has its most noticeable affect on the individual's mobility and agility. Due to arthritis and other muscular complications, finger dexterity decreases, various controls and latches are hard to manipulate, limits of reach become restricted between knee and shoulder height, walking may require assistance from prosthetic devices such as canes, walkers and wheelchairs. (When design-

ing for wheelchair use, most existing codes and design criteria will not be adequate due to the fact that older persons do not have upper body strength and lack proficiency in wheelchair use.) Head movement becomes restricted when the neck is craned from left to right or when looking up to the ceiling. Prolonged neck strain may restrict blood flow to the brain and cause fainting. Leg movement becomes restricted and difficulties in ascending stairs and entering a tub are experienced. General mobility throughout the environment becomes increasingly more difficult. Activities of daily living become more time-consuming and, in some cases, impossible to complete.

Since aging is a process and not a stagnant condition, the level of mobility and agility is continually changing. As outlined in research conducted by Lawton and Nahemow, environmental press on the degree of functional difficulty of the environment should be matched with the agility level of the individual. Since one's agility level is continually changing, the environment must also be adaptable to meet these changing needs. One should also note that an environment which is too easy for an individual's agility level can cause accelerated functional dependency. The ability to adapt a standardized environment to one's physical stature and agility level has been accomplished and proven economical by automotive technology. This design concept is just beginning to be addressed in the residential environment and is drastically needed by older persons due to the aging process. Every effort should be made to make environments for older persons as adaptable as possible to meet their level of mobility and agility.

Design responses are:

1. Outdoor walking areas should have a continuous smooth surface. Curb cuts should be provided at pedestrian access points. However, curbs should be eliminated completely wherever possible. A handrail should be provided along one side of the walkway. Benches should not be used for outdoor seating. Individual chairs with arms and backs should be provided. The residents will be able to form their own conversation group if the chairs are not permanently affixed. Fifty percent (50%) of gardening areas, if provided, should be raised at least 24" to allow for use from a wheelchair. Twenty-five percent (25%) of resident parking spaces should have a 3'-0" aisle to one side to allow for easier access.

2. The vestibule should not only serve as an airlock but also as an area for seating and wheelchair users could wait there. The doors should be automatic sliding doors activated by motion detectors, push buttons, or magnetic cards. Building directory and call systems, if provided, should have push button controls mounted at a height for wheelchair users. A shelf should also be provided to temporarily hold packages. A bench should be provided to sit while waiting for transportation or putting on boots or adjusting clothing.

3. Corridors and hallways should be a minimum of 8'-0" wide in health care facilities and 5'-9" wide in residential living facilities. Certain types of health care may benefit from planned activities in the hallways. In this case, the width should be expanded to accommodate these activities and still allow for the 8'-0" clearance required by code. Handrails should be designed with a flat area on top for the resting of one's forearm and still narrow enough with recesses for finger grip. Two mounting heights should be considered—one for upright ambulant individuals who will use their forearm for support (mounting height at 3'-6") and the other for wheelchair users who use the rail to pull themselves down the hall (mounting height at 2'-6").

4. Elevator cabs should have a minimum cab dimension of 5'-0" by 7'-6" for the most efficient accommodation of wheelchairs and stretchers. Handrails should be provided on three sides and a fold-down bench for packages or seating should be provided at the back of the cab. Carpeting of cab walls should be considered for acoustical and practical purposes. Door opening width should be a minimum of 3'-0". All elevator controls and emergency telephones should be mounted horizontally 3'-6" from floor to center line of controls on one side of the cab. All button controls should have raised or recessed numbers. (Button controls which require depression and stay depressed to activate are best for low visioned individuals). Light and bell indicators for cab arrival on each floor should be provided with differentiation for upward or downward travel. Motion detector door closing controls should be provided on the hallway side in lieu of lights, in that lights will not sense wheelchair wheel spokes or an individual's legs which are supported by a wheelchair in a stiff horizontal position. The leading edge of the elevator door should have a raised or depressed floor number.

5. Ramps should be avoided, if possible. However, when required, a maximum grade of 1'-0" of rise to 15'-0" run should not be exceeded. Handrails should be provided on each side.

Kitchens designed for older persons should take into account not only mobility disabilities but also vision and hearing losses. The open floor area should allow for access by wheelchair users. An "L" shape kitchen cabinet layout has proven to be the most successful with the third wall used for pantry-type storage (floor to ceiling adjustable shelves a minimum of 14" deep). Pull-out breadboards or cutting boards should be provided wherever possible. One board should have round holes of various sizes to stablize bowls while mixing. A storage area for a food cart should be proviced to limit the need for lifting and allowing one to place the necessary items close at hand.

The cabinetry under the sink should be designed to accommodate the wheelchair user as well as the individual who wishes to use a chair. This can be accomplished by providing cabinet doors which pivot into the cabinet itself and provide barrier-free front access. Drain pipes and hot water lines should be wrapped with insulation to eliminate the potential of burning one's legs. Shelving in lower cabinet storage areas should be mounted on drawer slides to allow for easy access to the rear of the shelf. All cabinetry doors and drawers should have large staple-type handles which do not require grasping between thumbs and forefingers. This grasping action is made difficult as a result of arthritis. At least one drawer large enough for a silverware divider tray should be provided next to the sink and also one drawer should be located adjacent to the range and wall oven for cooking utensils. Wall cabinets above counter—if used—should be 14" deep and mounted on adjustable brackets with maximum height of top shelf at approximately 5'-6". The kitchen countertop should also have the flexibility to allow for a mounting height between 2'-6" and 3'-0". The sink drain should have a slip connection and the hot and cold water feed lines should be accomplished by flexible connections. The adjustability can be accomplished by mounting the countertop brackets which can then be set by a maintenance person. Standard 29" high base cabinets could also be used with wood blocking added under the cabinet to attain the preferred mounting height.

Sinks should be placed toward the front of the counter to minimize stooping and stretching when reaching into the basin. Single lever faucet controls should be provided for the sink. The sink should be standard depth to allow for the washing of pots and pans. A range top and wall oven should be used in lieu of a standard stove. The range top should have staggered burners with a warning light when a burner is activated. The controls should be pushbutton and located to one side. The wall oven should have a side hinged door, if possible with controls no higher than 4'-6" when the bottom of the oven is mounted at countertop height. A breadboard should be located directly below the oven which can be covered with an asbestos-type material. This will protect the wheel-chair user from potential burns when removing hot platters from the oven. The oven door should have a hold-open latch to eliminate the possibility of the door swinging closed when arms are extended into the oven.

The refrigerator should have separate compartments for refrigeration and freezing. Side-by-side refrigerator-freezer types are preferred since reaching and stooping is then eliminated. All warning signals or timers on appliances should have a visual as well as an audible signal. At least one duplex outlet should be located on the front face of the base cabinetry to allow for the easy plug-in of various kitchen appliances.

7. The highest percentage of accidents occur in the bathroom and bathing areas. Therefore, these spaces must be analyzed very carefully for functional and safety considerations. The base floor area should be large enough to accommodate the wheelchair user. The water closet should have a standard height elongated bowl with a recessed base. This type of bowl will provide closer access by providing more free area for wheelchair foot pedals. If a higher-than-standard toilet seat is required, a filler piece can be added beneath the seat itself to achieve any desired height. Various styles of grab bars may be attached to the toilet seat and negate the need for blocking in the walls. This will also allo simple modifications as one's mobility level changes.

The sink should be mounted in a countertop to allow for wheelchair access and the countertop should be on adjustable brackets which would also require flexible and convertible plumbing connections. The drain for the sink should be located to the rear of the fixture to allow for greater maneuvering area for one in a sitting position. A single elongated lever should be used for water control. Mounting location should be to the side of the sink in the direction of the water closet. This location would eliminate reaching and stretching to the rear of the fixture and also would provide access for someone sitting on the water closet.

Mirrors should be located on the wall behind the sink as well as on the wall to one side of the sink. This will allow the individual to get closer to the mirror (necessitated by the fact that when shaving or applying make-up one generally does not

wear one's glasses) without leaning over the sink which is impossible for someone in a wheelchair. The mirrors should extend down to the countertop height in order to provide adequate coverage for someone in a sitting position.

Medicine cabinet type storage should be provided in side walls to negate the need for reaching over the countertop. Linen storage and storage for additional toiletry items should be provided within the bathroom.

The shower should provide for wheelchair access (no curb) and the floor material should have a non-slip surface. The non-slip surfaces should be throughout toilet and bathing areas. A horizontal grab bar should be mounted on all walls of the shower at 3'-0" high. A vertical grab bar should be mounted adjacent to the shower head and water control. A hand-held style shower head should be provided along with single lever water control which contains the non-scauld mixing valve. A swing down seat should be provided in the shower area within reach of the telephone, shower head, and control valve. A shower curtain and rod should be used in lieu of sliding doors.

An emergency call switch should be mounted adjacent to the water closet and shower with a pull cord that extends to the floor. A night light should be provided outside of the bathroom adjacent to the door to enable easier access for night time use.

8. All storage areas should be designed with adjustable shelves and rods. Two feet deep reach-in type storage is preferred in that maneuvering within a walk-in type closet is generally difficult. Doors should provide for full width access with horizontal sliding or bi-fold type hardware (vertical slated accordion type doors have been proven to be the best from a functional consideration).

9. Mailboxes—if provided in residential facilities—should be mounted no lower than 2'-6" nor higher than 5'-0". Locks should be key activated and the boxes should have large dark colored recessed or raised numbers on a light background. A shelf should be provided along the bottom of the mailboxes for the resting of packages.

In addressing the over-all design of facilities for older persons, a hierarchy of private and social spaces should be provided. This hierarchy should include areas for "oneness" or privacy. An area should allow for socialization of two to four persons without interference of other activities. Space should afford eight to ten persons the opportunity to socialize and engage in special activities. And, finally, a space should be provided for a large group to congregate for special events, presentations, films, and religious services.

In the residential setting the individuals can obtain privacy in their own apartment. However, this is not true of the typical bedroom in the long term health care facility. The design of the bedroom must carefully address not only the physical needs of older persons but also the psychological and social needs and still accommodate the nursing component. Various bed locations should be afforded to the residents to achieve optimum privacy and personalization. The head of the bed should not be visible from the hallway unless desired by the resident. (This is contrary to some administrator's policies. However, nursing staff cannot ascertain the well-being of a resident by viewing him or her from the hall. By forcing staff to enter the room and addressing the resident greater personal contact and assessment is achieved.)

Each resident should have direct access to his or her "own window" and have the ability to see outside while lying on one's bed. By providing a deep window sill approximately 18" from the floor, outdoor visual access may be attained, as well as the potential for a window seat or an area for personal memorabilia and hobbies such as plants. The area between the bed and the window should afford a personal area in which the resident may locate his or her own chair and personal items for various activities.

The implications for the double occupancy bedroom are that each room should have two windows with space adequate for beds to be located end to end parallel to the window wall. Egress space should be provided between the beds along with the draw curtain divider. The staff/service function can then be conducted primarily from the opposite side of the bed from the window and not interfer with personal activities.

A bedside stand should be selected which contains a nurse's call and a bedside light. Through the use of the cord from the bedside stand to a wall jack, greater flexibility is achieved for furniture locations. Nursing equipment and supplies—historically kept on top of and within the bedside stand—should be located in a small service cabinet just inside the door to the room. This will allow the resident to have full use of the bedside stand for items which should be close at hand such as eye glasses, dentures, books, letter writing, and other personal effects. The chest of

drawers should not be built in. The residents should have the opportunity to provide their own chest of drawers to increase the potential for personalization.

An area should be provided for wheelchair storage in that many residents use a wheelchair only to assist mobility to other parts of the facility. All duplex outlets should be no lower than 24" from the floor and switches no higher than 36".

Lounges, activity rooms, hobby areas and/or game areas should be provided for various sizes of groups to complete the hierarchy of social spaces. The multi-purpose room—which is typically provided and designed for various types of activities—becomes the "no purpose" room in that the only activity which is adequately accommodated is large group assembly. Each planned social area should have a focal activity to stimulate interaction and social exchange. Such areas might include: Library/Lounge, Greenhouse/Lounge, Laundry/Lounge, Music Room/Lounge, T.V. Room/Lounge, Men's Lounge/Pool Room, and various crafts, hobby, and game rooms which coincide with the cultural and ethnic interest of the intended user population. In designing new facilities a couple of space should be provided with no planned use so that the residents can decide which activity they would like to add.

The location of activity and social areas is of great importance in that the location will have a direct impact on the amount of use. Locations should be selected which center around high activity areas such as entrance lobbies, vertical circulation points, nursing stations or viewing points of activity outside of the facility. These locations should also be along the routes which a resident frequently travels and may be encouraged to participate by first viewing a particular activity. Barrier free restrooms should be provided adjacent to lounges and activity areas, due to the fact that many older persons experience incontinent problems and will not spend any duration of time where restrooms are not immediately available.

Small seating areas should be provided adjacent to functions which are scheduled in that older people will generally arrive prior to a scheduled time. These functions include: Beauty/Barber, Occupational Therapy, Physical Therapy and, most important, the Dining and Mail areas.

In furnishing social and activity areas one must keep in mind the anticipated number of people who will be using wheelchairs and provide adequate room for the wheelchair user to maneuver and join into social groups. This socialization is sometimes impaired by providing too much furniture. Socialization between able-bodied and mobility-impaired persons can be increased by providing tables which will partially screen prosthetic devices and maintain a more equal evaluation for eye to eye contact. Square or rectangular tables with rounded corners should be selected which are stable enough for a person to lean against when getting in and out of a chair. Many center pedestal tables will not provide adequate support. The table apron should be minimal to avoid pinched fingers from chair arms.

Chair selection should avoid seats which slope back and soft cushions which one sinks into when sitting down. Both of these design features make it difficult to get in or out of the chair. The seat should be shallow enough for one to sit firmly against the back and allow one's feet to rest comfortably on the floor. All chairs should have arms which extend beyond the front of the seat and an open front under the seat to allow one to place one's feet more directly under the body when standing up. The back should be high enough to support the shoulders on lounge chairs and, in come cases, head supports should also be provided.

Architectural and interior design for older persons will make advancements as new materials and products become available. The over-all satisfaction of the environment can only advance through the combined efforts of individuals with various professional backgrounds who continue to study older people and how they interface with the physical environment.

CHARTER HOUSE, A MODEL PROJECT

Charter House, located in Rochester, Minnesota, was programmed and designed by Design Through Research, Inc. of Minneapolis, Minnesota. It is a nonprofit corporation developed by Rochester Methodist Health Services, Inc. to meet the needs of older persons in its community and to accommodate the large number of persons wishing to relocate in Rochester for their retirement years.

Current statistics on the Charter House community show an average age of seventy-five years. The average yearly income is between $30,000 and $40,000 per year with total personal assets valued at approximately $250,000. Fifty percent of the residents are coming to the facility from outside of the Rochester community. Females outnumber males 65% to 35%. Couples account for approximately 45 percent of the population. The community is, on the whole, healthier, more active and more highly educated than average for this age group.

The project provides—in one facility—all levels of care and housing from a skilled nursing unit to independent living units. The physical environment and service programs have been designed to promote independent living. It is anticipated that only the most severely disabled persons will need to be admitted to the skilled care facility. "Assisted Living" services, such as home health aids, housekeeping services, adult day care, meals and various therapies are available on a fee-for-service basis to apartment residents. In addition, ten days of care per year in the skilled unit are provided in the basic service to each resident. By providing for the health and psycho-social needs of the apartment residents in their apartments, admission to the skilled care unit will be delayed or entirely avoided. The costs to the system and to the consumer for care of the aging will be greatly reduced by this approach.

Technology serves an important function in providing for the security of the project's residents. Apartment residents are provided with an emergency call system in each unit. Call stations are located in each bedroom and bathroom. The system is designed to operate on a simple pull switch or a portable wireless call switch, depending on the individual's personal needs. The call system will be monitored twenty-four hours per day with immediate response to a call for help coming from within the facility. Security personnel will also monitor the smoke alarms located throughout the building on a continuous basis.

Entry into the facility requires the use of a magnetic access card. Cards with differing access levels will be issued to residents and staff. All other entries to the facility are to be controlled by security staff. Closed circuit television will allow apartment residents to screen visitors and instruct security personnel to allow entry to visitors, or not.

The closed circuit television system will also be used to provide a great number of other services and conveniences to the project's residents. Daily menus activity schedules, educational and entertainment programs will be originated within the complex for viewing in the apartments. The closed circuit television can also be an important safety feature for the resident. Emergency bulletins can be superimposed on television screens throughout the project to alert residents of impending severe weather, fire or other emergency situations that might develop. In case of fire, there is an intercom system with a speaker in each unit dedicated to the exclusive use of the fire department. Safety precautions, exit routes, and other instructions can be given to the residents by the fire department in the unlikely event of a fire. Charter House is a completely sprinklered Type I fire resistive structure.

Although Charter House employs many sophisticated systems to insure the safety and health of its residents, each technology has been evaluated to insure that it is appropriate for this facility and is consistent with its goals. In the skilled care unit a relatively simple and unsophisticated call system was specified. It requires a nurse or health aid to go to the room in which a call for help originates to cancel the alarm. This reinforces a commitment to personal attention and care for the residents by the staff.

The Charter House facility has been designed with great care to meet the needs of older persons. The facility—including the apartment interiors—is completely "barrier free." The prevalence of mobility impairments in older persons makes this a must. The use of mobility aids will increase in the facility as the community ages together. It is important to note that standards for handicapped accessible design have been developed to meet the needs of younger and, therefore, stronger and healthier handicapped persons. These guidelines are in some cases inadequate or completely inappropriate for meeting the needs of the mobility-impaired senior. The design of Charter House recognizes the functional limitations that are a natural part of the aging process. The environment has been designed to compensate for these needs rather than simply complying with code minimum requirements.

Technology, programs, and the thoughtful physical design of Charter House combine to produce an environment that will insure that its residents will age with dignity. The Charter House retirement community—with its emphasis on independent living in a supportive environment—serves as a model for new retirement facilities throughout the country.

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